# INTENSITY CHANGES OF TROPICAL CYCLONES IN THE WESTERN NORTH PACIFIC OCEAN DURING 1960-1969

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# NAVAL POSTGRADUATE SCHOOL
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# THESIS

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by

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# Intensity Changes of Tropical Cyclones in The Western North Pacific Ocean During 1960-1969

by

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ABSTRACT

Six-hourly observations containing 18 parameters of tropical storms and typhoons in the western north Pacific Ocean during the period 1960 through 1969 were examined. The data were composited into four periods: before and after maximum intensity for East-West moving storms, and before and after recurvature for recurving storms.

Monthly and seasonal variations of tropical cyclone intensity, speed of movement and size were examined. Correlation coefficients of the 18 tropical storm and typhoon parameters were computed for each of the four composited periods of study. The four highest correlation values for the past 24-hour change of intensity parameter were checked for levels of significance.

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# I. INTRODUCTION

## A. HISTORY

Mature tropical cyclones,[1] called hurricanes in the Atlantic and typhoons in the western Pacific, are the most violent large-scale convective systems in the atmosphere. They form over the warm waters of all the tropical oceans except the South Atlantic [Dunn 1964]. Typhoons are neither the largest nor the most intense atmospheric storms, as they cannot compare in size with the winter storms of middle latitudes or match the concentrated winds found in tornadoes. However, the considerable size and great intensity of tropical storms make them the most dangerous and destructive of all storms.

The greatest damage and loss of life due to typhoons arise from storm surges that flood low-lying coastal areas with wind-driven seas, from flooding caused by the heavy rains, and from winds that frequently exceed 150 miles per hour. The great economic impact of these storms amply justifies efforts to study them. Observation of tropical cyclones, however, has not been easy. Prior to World War II, most of the data available for study were based on observations from ships at sea, by observers located on small islands or by a network of meteorological stations after a storm had moved inland. On 27 July

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[1] Tropical cyclonic circulations which at one time in the life cycle of the storm attained either tropical storm or typhoon intensity.

1943, Colonel J. P. Duckworthe made the first planned flight into the eye of a hurricane, proving the feasibility of aircraft reconnaissance of these storms. Routine reconnaissance flights by the Navy and Air Force have since contributed significantly to the detailed knowledge of both the structure and energetic processes of these storms. Measurements of winds, temperatures and pressures obtained during these flights have provided a fairly complete three-dimensional description of tropical storms[2] and typhoons.[3]

The advent of weather satellite pictures of cloud patterns has been of considerable value in synoptic meteorological analysis [Anderson, et al 1966]. These pictures have been of particular importance in remote portions of the oceans where conventional meteorological information may be lacking. In April 1960, for example, Tiros I, an experimental weather satellite, made meteorological history [Dunn 1964], by photographing an unreported fully developed tropical cyclone, located about 800 miles east of Brisbane, Australia. In addition to locating mesoscale weather patterns, the extent and appearance of cloud masses have been interpreted in terms of development or decay of significant synoptic features. Such observations serve as an important supplement to the aircraft reconnaissance data of

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[2] Tropical cyclonic circulations which at one time in the life cycle of the storm attained sustained wind speeds of 34 to 63 knots inclusive.

[3] Tropical cyclonic circulations which at one time in the life cycle of the storm attained sustained wind speeds of 64 knots or more.

tropical cyclones, resulting in a more complete history file of storm information.

## B. BACKGROUND

Various methods have been employed to describe the intensity of tropical cyclones in the western north Pacific Ocean. Frank and Jordan [1960] studied the climatological aspects of typhoons, utilizing central pressure data observed during the period 1950-1957. Riehl and Malkus [1961] suggested that the area covered with clouds capable of producing radar echoes varies directly with the intensity of the storm. Later, FUNG Yat-kong [1970] conducted a purely statistical analysis on the intensity of typhoons from 1958-1968, based on the minimum value of central sea level pressure. The extensive paper by Gray [1970] provided an updated statistical climatology of tropical cyclones in the western north Pacific Ocean.

More recently, Riehl [1971] examined recurving typhoons, showing the variation of intensity during recurvature. Brand and Gaya [1971] presented statistical information on the geographical and seasonal variations of tropical cyclone intensity changes, based on 25 years [1945-1969] of data. Finally, Brand [1972] found distinct geographic and seasonal preferences for both rapid intensification and low-latitude weakening of tropical cyclones in the western north Pacific Ocean.

## C. OBJECTIVES OF THE STUDY

The above investigations have shown that both a seasonal and geographic variation of tropical cyclone intensity exists.

Moreover, they tend to imply that the variations of intensity may have an important influence on the variation of other tropical cyclone parameters. However, there have been no studies which demonstrate the significance of the variation of tropical cyclone intensity and its relationship to the variation of other tropical cyclone parameters. It is therefore the purpose of this paper to describe:

1. The seasonal variation of tropical cyclone intensity as a function of maximum intensity, speed of movement and storm size.

2. The correlation of the available tropical cyclone parameters both before and after maximum intensity, and before and after recurvature.

## D. THE AREA OF STUDY

The tropical western north Pacific Ocean experience more than twice as many tropical storms or cyclones as any other area [Atkinson 1971]. It is also the only region where storms can occur in any month. Table I illustrates the cyclone activity of the past five years [FWC/JTWC 1971], during which era increased satellite coverage proved to be an invaluable aid in the detection of cyclones in the early stages of formation.

Figure 1 is a Mercator projection showing the portion of the western north Pacific Ocean used for this study. Land stations and ship reports are sparse in the western north Pacific Ocean, especially in the areas of tropical cyclone formation. The fixed reporting stations and a typical distribution of daily reports from transiting ships are shown in Fig. 1.

The importance of the area to the Navy is clearly demonstrated in Table II. It lists the number, points of origin and destination of Navy ships, and additional ships under Navy contract, which transited the area during the calendar year 1971. Information concerning the number of non-Navy ships was not available. Not all ships which transit the areas of cyclone genesis report weather, and once the cyclone moves into the shipping lanes, it is usually of such intensity that ships will take evasive action. Because of this lack of data, one of the greatest aids in locating cyclones has been the Automatic Picture Transmission (APT) satellite pictures received via Forecasters Facsimile (FOFAX) [FWC/JTWC 1971]. This additional information helps to augment the available reconnaissance data of tropical cyclones.

TABLE I

A tabulation of tropical cyclone activity in the western north Pacific Ocean, 1967-1971 [FWC/JTWC 1971].

| | 1967 | 1968 | 1969 | 1970 | 1971 |
|---|---|---|---|---|---|
| Total number of warnings | 957 | 822 | 430 | 533 | 747 |
| Calendar days of warnings | 185 | 142 | 108 | 127 | 163 |
| Tropical depressions[4] | 6 | 4 | 4 | 3 | 2 |
| Tropical storms | 15 | 7 | 6 | 12 | 11 |
| Typhoons | 20 | 20 | 13 | 12 | 24 |
| Total tropical cyclones | 41 | 31 | 23 | 27 | 37 |

[4] A weak tropical cyclone circulation with highest sustained wind speeds (average over one minute or longer period) of less than 34 knots.

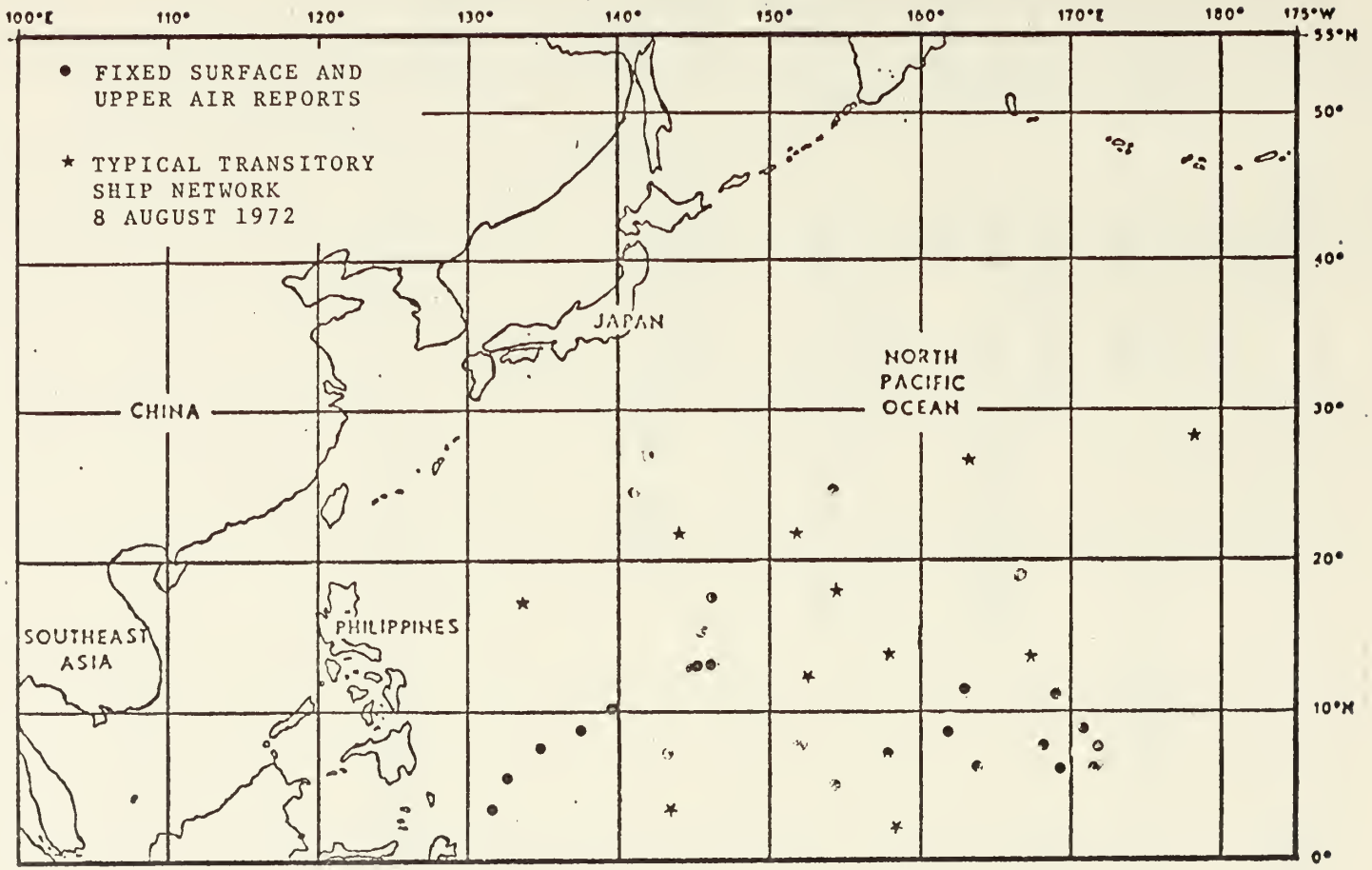


Figure 1. The area of the western north Pacific Ocean used in this study, with fixed and transitory surface observation networks.

TABLE II

A tabulation of the number of ships, either Navy or Navy contract vessels, which transited the western north Pacific Ocean during calendar year 1971 [FNWC 1972].

| Ports | Westbound | Eastbound |
|---|---|---|
| Washington, Oregon - South China Sea | 4 | 3 |
| Washington, Oregon - Japan, Korea, Okinawa, Taiwan | 1 | 11 |
| Washington, Oregon - Guam | 10 | 13 |
| California - South China Sea | 121 | 65 |
| California - Japan, Korea, Okinawa, Taiwan | 41 | 88 |
| California - Guam | 21 | 16 |
| Canal Zone - South China Sea | 96 | 43 |
| Canal Zone - Japan, Korea, Okinawa, Taiwan | 16 | 50 |
| Canal Zone - Guam | 3 | 12 |
| Hawaii - South China Sea | 32 | 14 |
| Hawaii - Japan, Korea, Okinawa, Taiwan | 12 | 33 |
| Hawaii - Guam | 11 | 15 |
| Sub-totals | 368 | 363 |
| Total | 731 | |

## II. DATA

### A. DATA SOURCES

The data used for this study were extracted from a file of tropical storms and typhoons of the western north Pacific Ocean, compiled by the National Climatic Center for the Navy Weather Research Facility. The history file was comprised of data from the following sources:

1. Synoptic Charts

| Period | Preparing Agency | Location |
|---|---|---|
| 1/45-12/47 | U.S. Air Force Weather Central | Andrews AFB, Md. |
| 1/45- 4/60 | U.S. Air Force Weather Central | Tokyo, Japan |
| 7/45-12/45 | U.S. Weather Bureau | Washington, D.C. |
| 1/45-12/67 | U.S. Air Force, Anderson AFB | Guam, M.I. |
| 5/59-12/66 | U.S. Navy, FLEWEACEN/JTWC | Guam, M.I. |
| 1/67-12/69 | ESSA, NMC | Washington, D.C. |
| 1/45-12/54 | U.S. Navy and U.S. Air Force | Various |

2. Publications

Annual Typhoon Reports, Fleet Weather Central/Joint Typhoon. Warning Center, Guam, 1953-1969.

Memoirs of the Central Meteorological Observatory, Japan.

A Report on the Typhoons and Tropical Depressions (Philippines) 1947-1949, 1951-1954, and 1956-1958.

Meteorological Results of Royal Observatory, Hong Kong, 1947-1958.

Typhoons of the Western Pacific, August-October 1945, 7th Amphibious Force Aerological Unit.

Typhoon Reconnaissance-Meteorological Squadron One - May to November 1946, Office of the Chief of Naval Operations, Washington, D.C.

3. Reconnaissance Data

Air Force Reconnaissance Forms, 1947-1968.

Navy Reconnaissance Forms, 1962-1969.

These data sources provided detailed storm-track information. This resulted in the compiled, history file of six-hourly information on the tropical storms and typhoons which occurred during the period 1945 through 1969. For this study the tropical storms and typhoons during the period 1960-1969 were examined, with primary emphasis given to the investigation of storm intensity as a function of other storm parameters.

The following sea-level (and 700-mb where specified) parameters constituted the available data for this paper:

a. Latitude, in degrees and tenths.

b. Longitude, in degrees and tenths.

c. Past 12-hour direction of movement, in degrees.

d. Past 12-hour speed of movement, in knots.

e. Past 24-hour direction of movement, in degrees.

f. Past 24-hour speed of movement, in knots.

g. Size, as the average radius of the outer closed isobar, in whole degrees of latitude.

h. Past 12-hour change of size, in degrees latitude.

i. Minimum observed sea-level pressure, in whole millibars.

j. Past 12-hour change in minimum sea-level pressure, in mb.

k. Maximum intensity (maximum observed wind), in knots.

l. Minimum 700-mb height, in tens of meters.

m. Latitude of the 700-mb ridge north of the storm, in whole degrees.

n. 700-mb height at the ridge line north of the storm, in tens of meters.

o. Longitude at 35N of the nearest 700-mb trough west of the storm, in whole degrees.

p. 700-mb height at the intersection of the trough line at 35N, in tens of meters.

q. Past 12-hour change of intensity, in knots.

r. Past 24-hour change of intensity, in knots.

These 18 data elements were available for each six-hourly observation of the tropical cyclones examined in this study.

## III. PROCEDURES AND METHOD OF ANALYSIS

### A. PRELIMINARY CRITERIA FOR DATA SELECTION

Following the selection of the area, all the tropical cyclones which occurred during the period 1960 through 1969 were examined. The tracks of these storms are presented in Appendix A. Because of the large variations in the storm tracks, the cyclones were grouped according to the characteristics exhibited by the individual tracks. This analysis resulted in the following representative classifications: (1) East-West moving Storms: Storms that generally proceeded in a westerly direction, having never looped or recurved; (2) Recurving Storms: Storms which experienced a clockwise change in the direction of movement, from an initial westward component to an eastward component; (3) Looping Storms: Storms that illustrated a complete loop in the track, which was formed by the more recent path of the storm crossing its previous track; (4) Northeasterly moving Storms: Storms which generally had an initial northeasterly heading, and which continued to track to the northeast of its initial observation point.

For the purpose of this study, it was decided to investigate only the East-West moving storms and recurving storms, as defined above. Furthermore, each tropical cyclone was required to have at least a 24-hour history, with its genesis having occurred east of 125E. This requirement eliminated the less intense, short-lived storms which would have otherwise biased

the rest of the data. Moreover, a more representative sample of recurving storms was obtained by excluding the recurving storms which had any portion of their tracks west of 125E.

In addition, a storm was not included in this study if its first observation recorded a maximum intensity of the storm greater than 65 knots. Finally, only those continuous track segments which remained over the open ocean were considered. If a storm encountered a land mass such as the Philippines, Taiwan, Japan or the Chinese mainland, its subsequent data were discontinued after the most recent observation prior to landfall. This requirement was imposed in consideration of the recently documented effects of terrain on the behavior of tropical cyclones [Brand 1972].

Table III is a summary, grouped by monthly and half-monthly periods, of the storms which were deleted by the application of the preceding criteria. It shows that of the original 295 tropical cyclones which occurred during 1960-1969, there were 24 which experienced looping and 18 that conformed to the given definition of northeasterly moving storms. Fourteen recurving storms had paths which tracked west of 125E longitude, 11 of which later crossed land. Only five storms had less than a 24-hour history, caused by either the small number of observations made in the storm or the fact that the storm encountered land shortly after the first observation. Another 48 storms that formed west of 125E and five storms that had an initial recorded intensity greater than 65 knots were deleted from the sample.

TABLE III

A listing of the various categories of storms deleted, by monthly and half-monthly periods.

| Period | Looping storms | North-easterly storms | Recurving storms with track west of 125E | Less than 24-hour history | Genesis west of 125E | Initial intensity exceeded 65 knots |
|---|---|---|---|---|---|---|
| Jan | 1 | | | | | |
| Feb | | | | | 1 | |
| Mar | | | | | | |
| Apr | | 1 | | | 2 | |
| May | 1 | 1 | 2 | 1 | 4 | |
| Jun | 1 | 1 | 2 | | 5 | |
| Jul 1 - 15 | | 1 | 2 | | 2 | |
| Jul 16- 31 | 4 | 3 | 2 | 1 | 4 | |
| Aug 1 - 15 | 1 | 4 | 1 | | 3 | |
| Aug 16- 31 | 7 | 2 | 1 | | 3 | 1 |
| Sep 1 - 15 | | 1 | | | 9 | |
| Sep 16- 30 | 2 | | 1 | | 2 | 1 |
| Oct 1 - 15 | 3 | 3 | 1 | | | |
| Oct 16- 31 | 2 | | | 1 | 2 | 1 |
| Nov 1 - 15 | | | | 1 | 5 | 1 |
| Nov 16- 30 | 2 | | | | 2 | |
| Dec | | 1 | 2 | 1 | 4 | |
| Totals | 24 | 18 | 14 | 5 | 48 | 4 |

B. DATA UTILIZED

Table IV lists, by monthly periods,[5] the remaining tropical storms and typhoons which were used in this study. The table indicates an August-September peak for tropical storms and typhoons, which compares favorably with the findings of Brand [1972] for the 25-year period 1945-1969. East-West storms also were most frequent in August and September, whereas the largest number of recurving storms was during October.

Figure 2 portrays the monthly frequency distribution of the 3,950 six-hourly observations that remained after excluding those storms that did not satisfy the selection criteria. The maximum number of six-hourly observations occurred in August, and the minimum number in February. It is interesting to notice that even though the month of February had the fewest number of observations, it had a greater number of storms than did the month of January. The reason for this can be realized by examining the storm tracks in Appendix A, which illustrate the variation in the track length, and thus the difference in the number of six-hourly observations.

Another notable feature of Fig. 2 is the limited period during which the largest number of observations occurred. Eighty-three percent of the total number of East-West observations occurred during the period July through November. Seventy-nine percent of the total number of observations in the recurving storms occurred between August and November. Together, these

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[5] Storms are categorized by month according to the midpoint in time of the total storm track.

TABLE IV

Tropical storms and typhoons classified as East-West storms and recurving storms, as separated by monthly periods for the years 1960-1969

| Period | Total Tropical Storms and Typhoons per Period | Percent of Total Number of Storms | East-West Storms per Period | Recurving Storms per Period |
|---|---|---|---|---|
| January | 3 | 2% | 1 | 2 |
| February | 4 | 2 | 4 | 0 |
| March | 5 | 3 | 3 | 2 |
| April | 5 | 3 | 3 | 2 |
| May | 4 | 2 | 4 | 0 |
| June | 10 | 6 | 6 | 4 |
| July | 23 | 12 | 21 | 2 |
| August | 38 | 21 | 26 | 12 |
| September | 39 | 21 | 26 | 13 |
| October | 29 | 16 | 9 | 20 |
| November | 18 | 10 | 9 | 9 |
| December | 4 | 2 | 2 | 2 |
| Totals | 182 | 100% | 114 | 68 |

two periods comprised 80 percent of the total number of 1960-1969 six-hourly observations, and are the object of examination in the following sections.

C. ANALYSIS OF EAST-WEST STORMS

The months from July through November for the years 1960-1969 were examined. During this period there were 91 East-West storms, consisting of 1,641 six-hourly observations. The data were separated into two periods within the life cycle of these storms. The first period contained those observations during

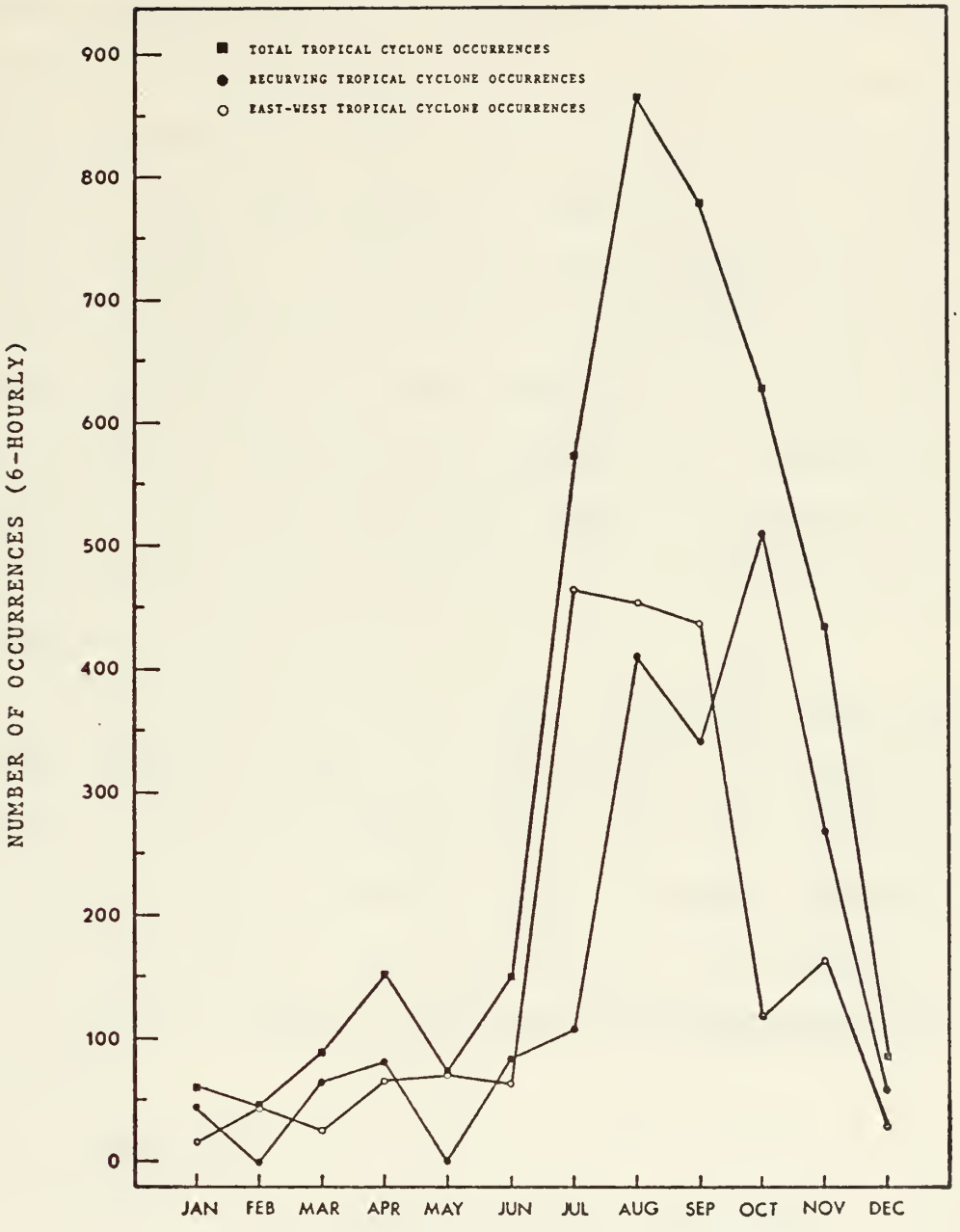


Figure 2. Monthly frequency distribution of tropical cyclone occurrences in the western north Pacific for tropical cyclones which reached tropical storm or typhoon intensity. The occurrences are based on 6-hourly reports during the period 1960-1969. Distributions are also presented for recurving and East-West moving tropical cyclones.

which the storms were intensifying, and included the first six-hourly observation of the maximum intensity. Nine of the East-West storms encountered land prior to reaching maximum intensity. In these cases, the most recent six-hourly observation prior to landfall was treated as the time of maximum intensity. The second period extended from the time the storms started to weaken - or from the second observation of maximum intensity - to the final six-hourly observation of the storms. It should be pointed out that the second period did not include those storms that experienced landfall after reaching maximum intensity. For this reason, the point of maximum intensity is shown as discontinuous in Figs. 3, 4 and 5 to indicate the differences in the sample.

An effort was made to show only the major characteristics of these storms and their relationships to the point of maximum intensity. This was accomplished by plotting for each storm only those averages on either side of maximum intensity which included two-thirds of the sample size at the maximum intensity value. Thus the general character of the parameters was maintained.

1. Intensity

Figure 3 portrays the monthly variation of average intensity relative to the points of maximum intensity (maximum observed wind speed) of 91 East-West tropical storms and typhoons. Tropical storms and typhoons during October were less intense throughout the intensification period, achieving an average maximum intensity of 79 knots. Following maximum intensity,

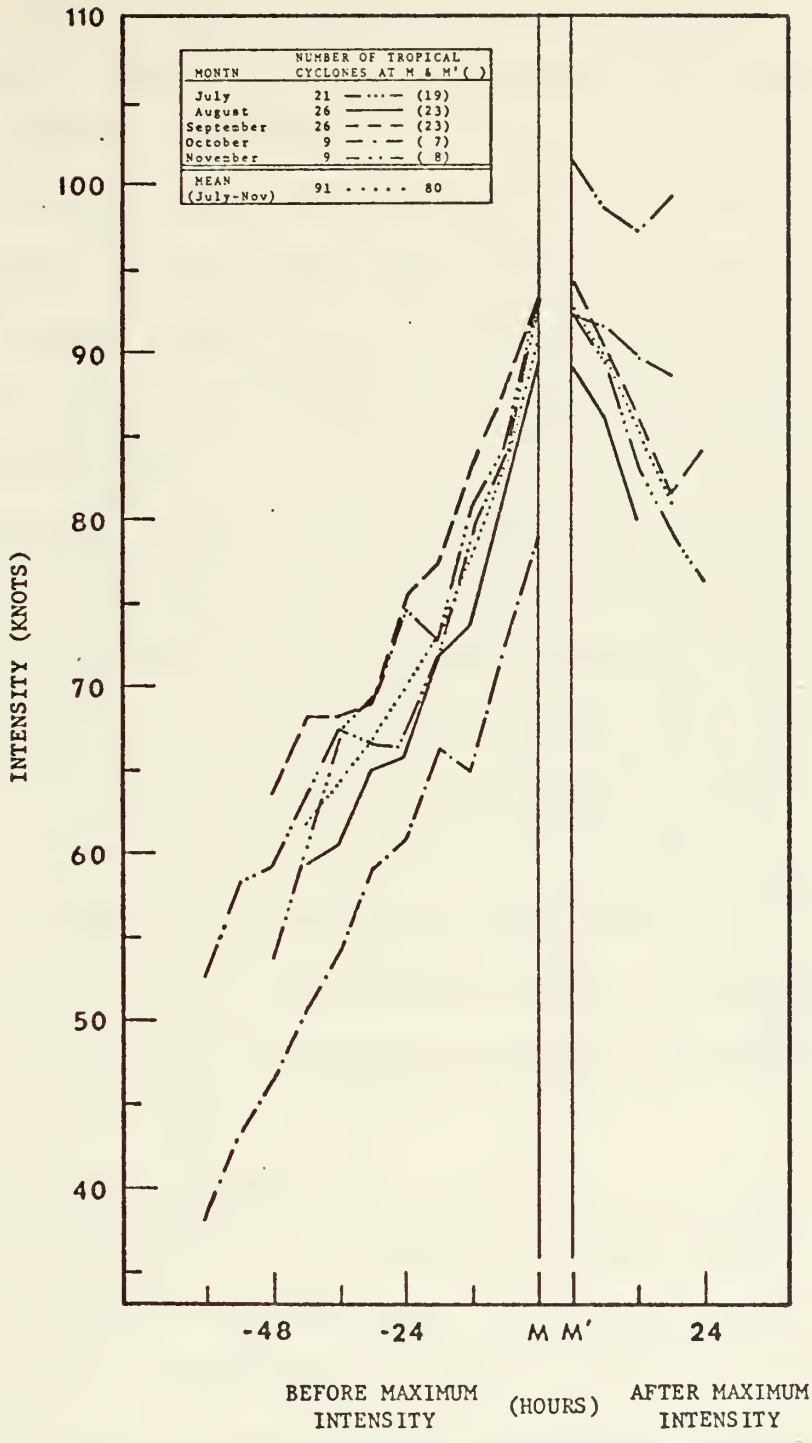


Figure 3. Intensity versus time profiles for east to west moving tropical cyclones (july-November, 1960-1969) relative to the point at which the storms reached their maximum intensity. Monthly profiles are presented for the months July through November as well as a mean for the 5-month period. The discontinuity at M and M' exists due to the storms hitting landfall at their maximum intensity.

the October storms were the slowest ones to weaken. In contrast, the month having storms of greatest intensity, reaching an average maximum intensity of 93 knots, was September. During the 24-hour period preceding maximum intensity, the November storms had the most rapid rate of intensification. Following maximum intensity, the November storms were also the most intense, while the storms during July exhibited the fastest rate of dissipation.

Compared to the 10-year weighted mean, the September storms were consistently of greater intensity both before and after maximum intensity. During the intensification period, August and October storms were less intense than the mean of storms for all months. It is of particular interest to notice that during the dissipation period, the earlier season months of July and August had storms that were less intense than the 10-year mean while the later season months of September, October and November had storms of greater intensity than the mean.

2. Speed of Movement

Figure 4 presents the monthly average speed of movement, plotted with respect to the time of maximum intensity of the East-West storms. Although the range of speeds is small, it is significant to note that a distinct monthly variation does exist. Figure 4 shows that October storms reached their maximum speed of movement earlier than storms in other months. At the point of maximum intensity, the October storms had the smallest speed of movement of all months, and experienced a slight increase in speed after maximum intensity.

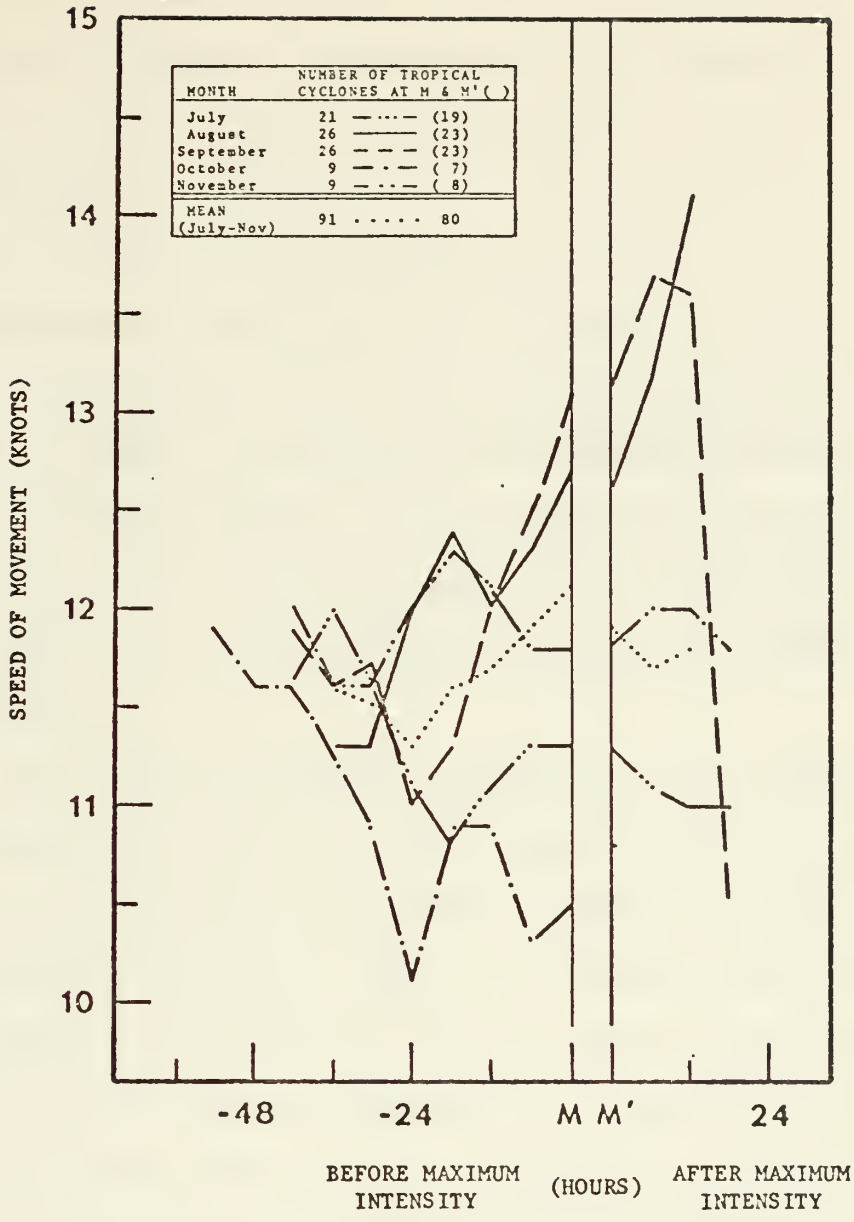


Figure 4. Speed of movement versus time profiles for east to west moving tropical cyclones (July-November, 1960-1969) relative to the point at which the storms reached their maximum intensity. Monthly profiles are presented for the months July through November as well as a mean for the 5-month period. The discontinuity at M and M' exists due to the storm hitting landfall at their maximum intensity.

The September storms show a minimum speed of movement at the same six-hourly observation prior to maximum intensity as do the October storms, and the overall average. After this minimum, the September storms demonstrated the greatest increase in speed prior to maximum intensity, at which time they attained the largest speed of movement of all months. Much like the August storms, the September storms showed an increase in speed of movement after maximum intensity. After reaching maximum intensity at about six hours into the dissipation period, the September storms showed a continuous and abrupt decrease in speed, whereas the August storms continued to accelerate.

The speed of movement patterns for the months of July and November were almost exactly opposite, as shown in Fig. 4. The July storms experienced their minimum speed at 18 hours before maximum intensity, when the November storms showed a maximum speed. Furthermore, as the speed of the July storms increased toward maximum intensity, the speed of the November storms decreased. The converse is again seen following maximum intensity. The July storms showed a decrease in speed, the November storms showed an initial increase in speed.

The ten-year mean speed of movement, shown in Fig. 4, shows a minimum speed being reached at about 24 hours preceding maximum intensity, followed by a gradual and continuous increase in speed as the maximum intensity is approached. Following maximum intensity, the mean speed showed a general decrease. Whereas the storms in July, August and September attain maximum

speed of movement either at or following maximum intensity, the storms in October and November reach their maximum speed of movement prior to maximum intensity.

Comparing Figs. 2 and 3 it is seen that a relationship exists between the intensity and the speed of movement. Prior to maximum intensity, the faster moving storms (September) are shown to correspond with those of maximum intensity. Similarly, the slower moving storms (October) correspond with the storms of least intensity. These findings are consistent with those of Shea [1972] who showed that the faster moving hurricanes in the Atlantic Ocean exhibit stronger winds than do the slower moving storms.

3. Storm Size

Figure 5 shows the monthly variation of average storm size[6] plotted with respect to the points of maximum intensity of the East-West storms. August has the smaller tropical storms and typhoons, which reach largest size before maximum intensity and continue to decrease in size afterward. On the other hand, October storms show a dramatic increase in size prior to maximum intensity, and increase to the largest of all months after maximum intensity. The November observations begin as the largest storm size of all months prior to maximum intensity, decrease sharply in size shortly thereafter and later stabilize within 24 hours of maximum intensity with the

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[6] Storm size was defined to be the mean radius in degrees of latitude from the center of the tropical cyclone to the outer closed surface isobar.

| MONTH | NUMBER OF TROPICAL CYCLONES AT M & M'( ) | |
|---|---|---|
| July | 21 | (19) |
| August | 26 | (23) |
| September | 26 | (23) |
| October | 9 | ( 7) |
| November | 9 | ( 8) |
| MEAN (July-Nov) | 91 | 80 |

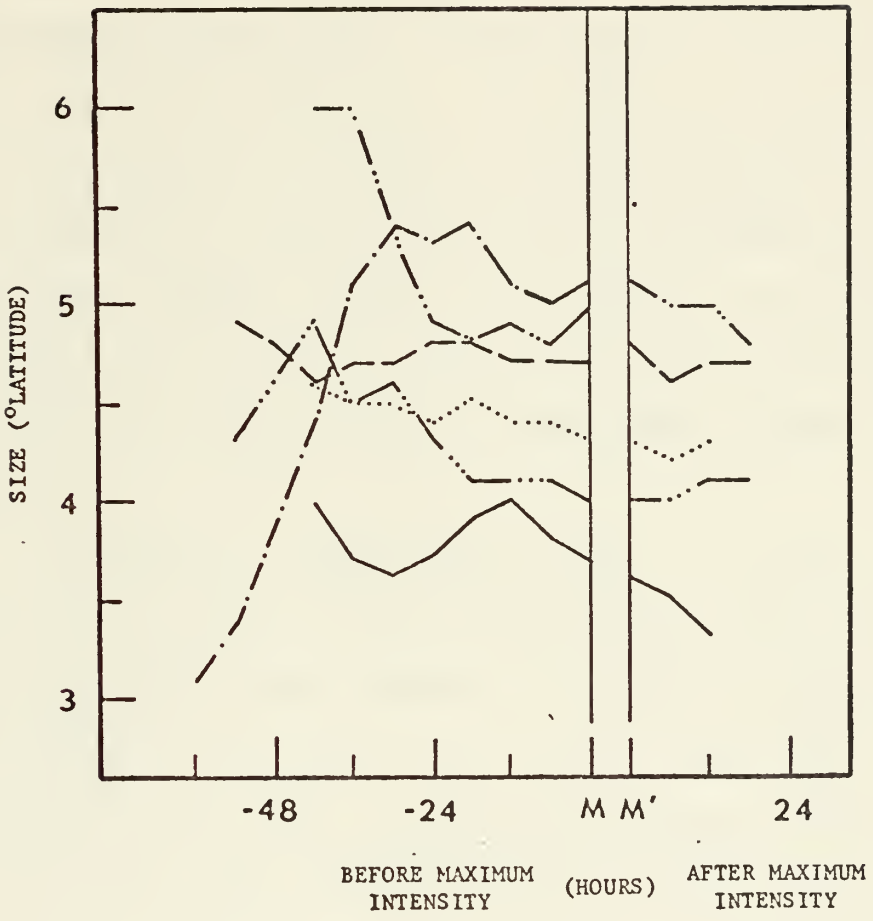


Figure 5. Tropical cyclone size (average radius to outer closed surface isobar in degrees latitude) versus time profiles for east to west moving tropical cyclones (July-November, 1960-1969) relative to the point at which the storms reached their maximum intensity. Monthly profiles are presented for the months July through November as well as a mean for the 5-month period. The discontinuity at M and M' exists due to the storms hitting landfall at their maximum intensity.

second-largest storms. In comparison with the other months, the month of September appears generally void of either maximum or minimum extremes in storm size.

In Fig. 5, the 10-year mean storm size for the period July through November shows a monthly stratification within 24 hours of maximum intensity. The distribution of the monthly average size of tropical cyclones as shown in Fig. 5 gives evidence of a seasonal preference for both very large and very small tropical storms and typhoons. The smaller size storms are shown to occur in July and August, and the larger storms during the later months of September, October and November.

In summary, a comparison of Figs. 3, 4 and 5 shows the existence of some definite correlations. While September is the month of the most intense and fastest moving storms prior to maximum intensity, it is not the month that has the largest size storms. It is the least intense, slower moving storms of October which are the largest storms. The more intense, faster moving storms of August are the smallest size storms.

After maximum intensity, the least intense storms of August continue to be the fastest moving storms, as well as the smallest. The more intense storms of the later season (September, October and November) tend to be the larger storms.

## D. ANALYSIS OF RECURVING STORMS

The months of August through November for the years 1960-1969 were examined. This four-month period included 54

recurving storms, accounting for 1,535 six-hourly observations. As was the case for the East-West storms, the six-hourly observations were plotted relative to the point of maximum intensity. The data were separately composited during two other periods. The first composite covered the period prior to the point of recurvature.[7] The second composite covered the period extending from the point of recurvature to the last six-hourly observation.

The criterion used for plotting the singular six-hourly observations of the recurving storms was that only those averages which included two-thirds of the sample size at the point of recurvature were plotted on either side of the point of recurvature. Utilizing this method, the major characteristics of the recurving storms as related to the point of recurvature were displayed.

1. Intensity

Curves portraying the average monthly variation of intensity prior and subsequent to maximum intensity of the recurving storms are presented in Fig. 6. A survey of Fig. 6 reveals a few salient facts. For the recurving storms, a much greater number of six-hourly observations exists both before and after maximum intensity than for the East-West storms discussed earlier. Furthermore, the number of observations before the point of recurvature was larger than after recurvature. Based

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[7] The observation at which the track of the tropical cyclone demonstrates a clockwise change in the direction of movement, from a westward component to an eastward component.

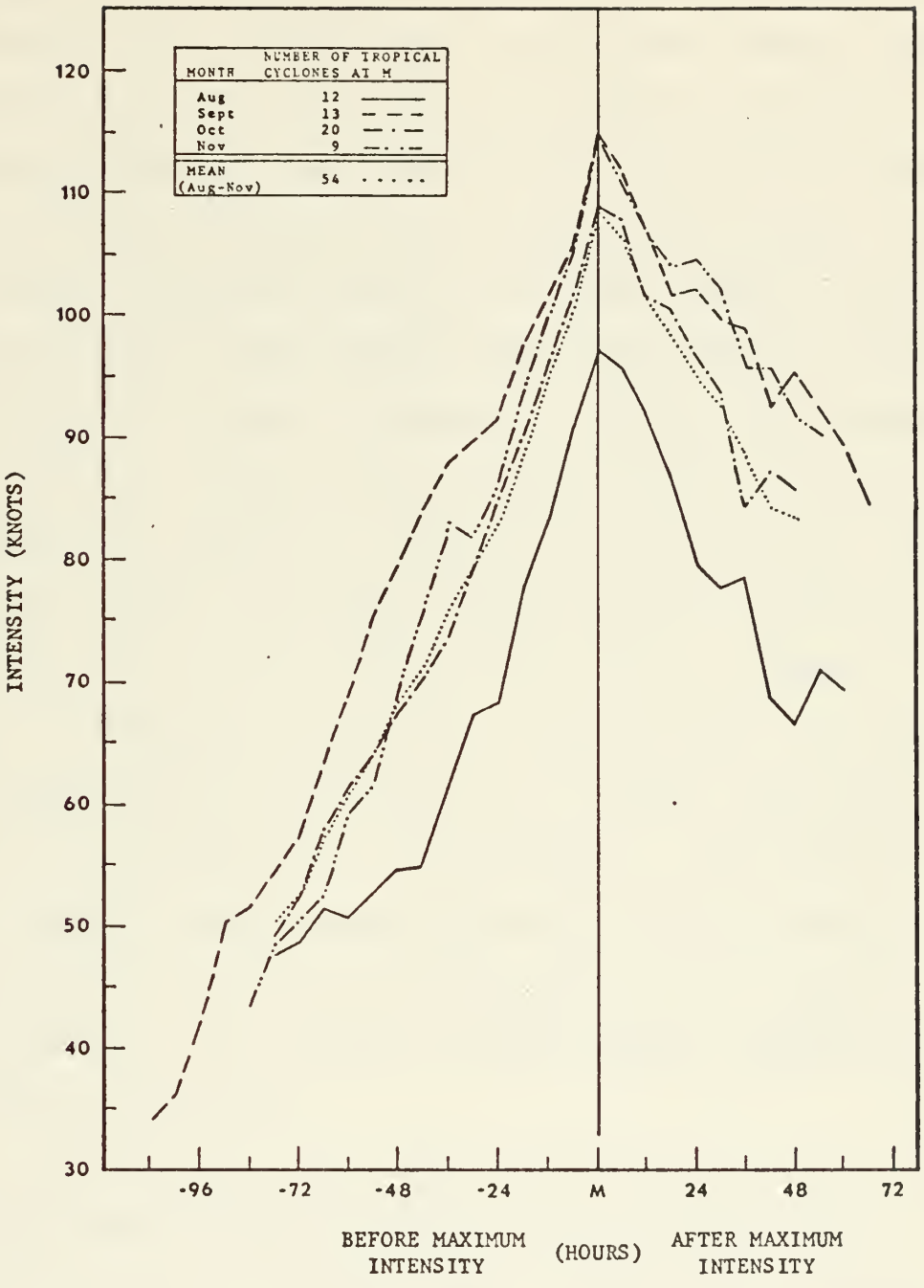


Figure 6. Intensity versus time profiles for recurving tropical cyclones (August-November, 1960-1969) relative to the point at which the storms reached their maximum intensity. Monthly profiles are presented for the months August-November as well as a mean for the 4-month period.

upon the criterion for inclusion of these values, the profiles indicate that the recurving tropical storms and typhoons were consistently more intense than the East-West moving tropical cyclones during the same month. In addition, September and November storms had the longest tracks before recurvature. The plots further indicate an early seasonal preference for the less intense recurving tropical cyclones, namely, during the month of August. More intense recurving tropical storms and typhoons tend to occur in September, October and November.

Figure 7 shows the variation of the monthly average intensity with respect to the point of recurvature. The September tropical cyclones reached maximum intensity more than two days prior to the point of recurvature. November storms showed a continuous increase in intensity from three days before recurvature up to the point of greatest intensity of all months at 12 hours prior to recurvature. The tropical cyclones during October demonstrated a symmetric bimodal maximum intensity with respect to the time of recurvature, with a relative minimum at recurvature. By contrast, August storms reached peak intensity after recurvature.

For the ten-year weighted mean shown in Fig. 7, the monthly average maximum intensity occurred more than 24 hours prior to the point of recurvature. Riehl [1971] examined the intensity of 66 recurving typhoons for the period 1957-1968 and concluded that virtually all typhoons reached their peak intensity at, or a little before, the point of recurvature and subsequently decreased.

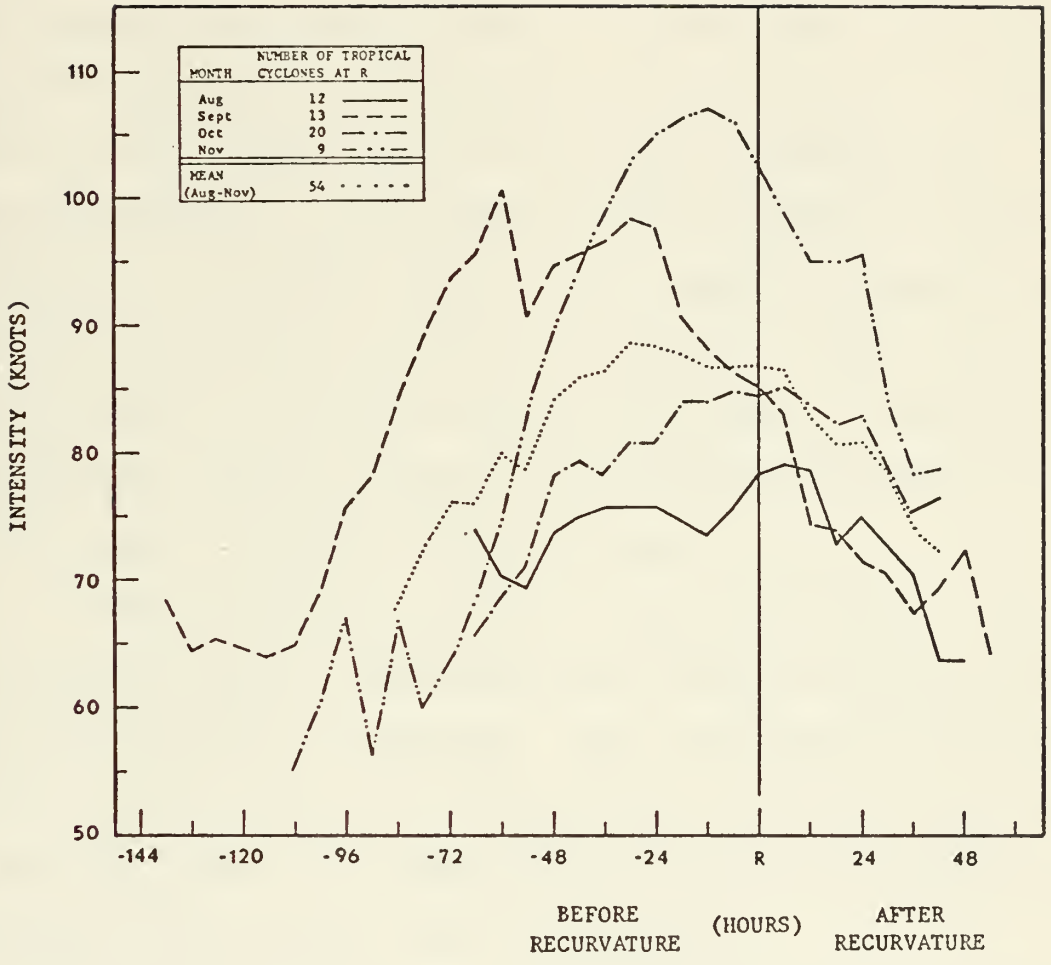


Figure 7. Intensity versus time profiles for recurving tropical cyclones (August-November, 1960-1969) relative to the point of recurvature. Monthly profiles are presented for the months August-November as well as a mean for the 4-month period.

2. Speed of Movement

The monthly average speed of movement variations are presented in Fig. 8, with respect to the point of recurvature. It is interesting to note that except for September storms, which experienced minimum speed of movement more than three and one-half days before recurvature, all the storms had a minimum speed within 12 hours prior to the time of recurvature. Except during September, all the storms showed a marked acceleration immediately after recurvature. The largest increase in speed following recurvature occurred in November. After a monthly average speed of about ten knots at the point of recurvature, the November tropical storms and typhoons accelerated to an average speed of approximately 27 knots.

Figure 8 further shows the speed of movement after recurvature generally increased with the progression of the season from August to November. This is consistent with the findings of Burroughs and Brand [1972], who further developed forecast equations for predicting the speed of movement of tropical storms and typhoons after recurvature.

Comparing Fig. 8 with Fig. 7 indicated that within 24 hours prior to recurvature, the less intense storms of August and October were also the slower moving storms. The more intense and faster moving storms occurred in September and November. Of particular interest is the fact that the most intense storms of November experienced their maximum intensity just six hours before reaching their minimum speed of movement. After recurvature, November storms had both the most intense and fastest moving tropical storms and typhoons.

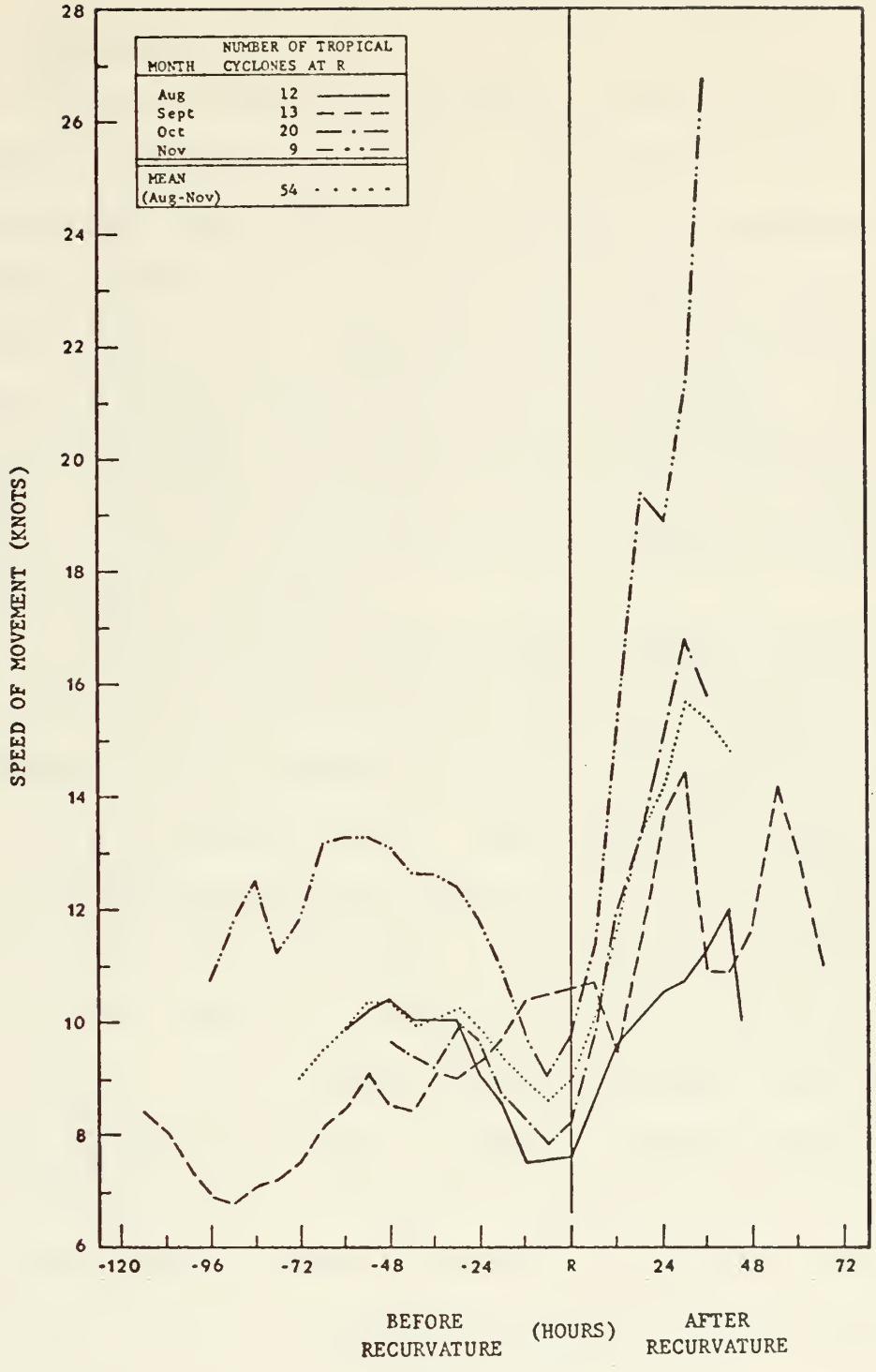


Figure 8. Speed of movement versus time profiles for recurving tropical cyclones (August-November, 1960-1969) relative to the point of recurvature. Monthly profiles are presented for the months August-November as well as a mean for the 4-month period.

3. Storm Size

Figure 9 shows the variation of the monthly storm size for recurving tropical cyclones. Furthermore, Fig. 9 shows that both very large and very small tropical storms and typhoons have seasonal preferences. The earlier season storms of August were the smaller ones. The maximum size of August storms occurred two and one-half days before recurvature. After this time, they generally decreased in size until six hours prior to recurving, at which time they began to steadily increase in size for another 30 hours.

In comparison with the 10-year weighted mean, Fig. 9 clearly shows that within two days prior to recurvature, August and November had the smaller storms whereas September and October had the larger storms. The summing of opposite tendencies in the different months resulted in a rather flat curve of no significant size variations. From August to October, there appears to be a definite preference for the larger storms later in the season. The October storms had minimum size two and one-half days before recurvature. Then the storms increased in size and reached the maximum size of all months at 30 hours before recurvature. After interim fluctuations in size, the October storms again reached the same maximum size at six hours before recurvature and at 24 hours after recurvature.

The September storms attained maximum size 30 hours prior to recurving, and generally decreased in size thereafter, as shown in Fig. 9. November had a maximum storm size more than three and one-half days before recurvature, then decreased to a minimum size 12 hours before recurvature. The November storms


Figure 9. Tropical cyclone size (average radius to outer closed surface isobar in degrees latitude) versus time profiles for recurving tropical cyclones (August-November, 1960-1969) relative to the point of recurvature. Monthly profiles are presented for the months August-November as well as a mean for the 4-month period.

then increased in size through recurvature to reach a smaller, secondary maximum 18 hours after recurvature.

The seasonal variation of the parameters for recurving storms, as shown in Figs. 7, 8 and 9, suggest several interrelationships. Prior to the point of recurvature, the less intense, slower moving tropical storms and typhoons of August were observed as also the smallest storms. The more intense storms of September and November were also the faster moving storms, but were not the largest storms. The August storms displayed practically the same characteristics after recurvature as they did before recurvature; they continued in time as the least intense, slowest moving and smallest storms of the period studied.

## E. COMPARISON OF THE 10-YEAR WEIGHTED MEANS OF EAST-WEST AND RECURVING STORMS

For ease of comparison the 10-year weighted means of storm intensity, speed of movement and size are presented for the East-West and recurving storms in Figs. 10 and 11, respectively. During the period 48 to 24 hours prior to maximum intensity, the average of the East-West storms (Fig. 10), showed a decrease in speed of movement while intensifying. In the final 24 hours before reaching maximum intensity, the East-West storms accelerated. Furthermore, the East-West storms tended to generally decrease in size throughout both the intensification and dissipation periods.

In the mean, the maximum intensity of the recurving storms (Fig. 11), was reached 21 hours prior to recurvature. The mean

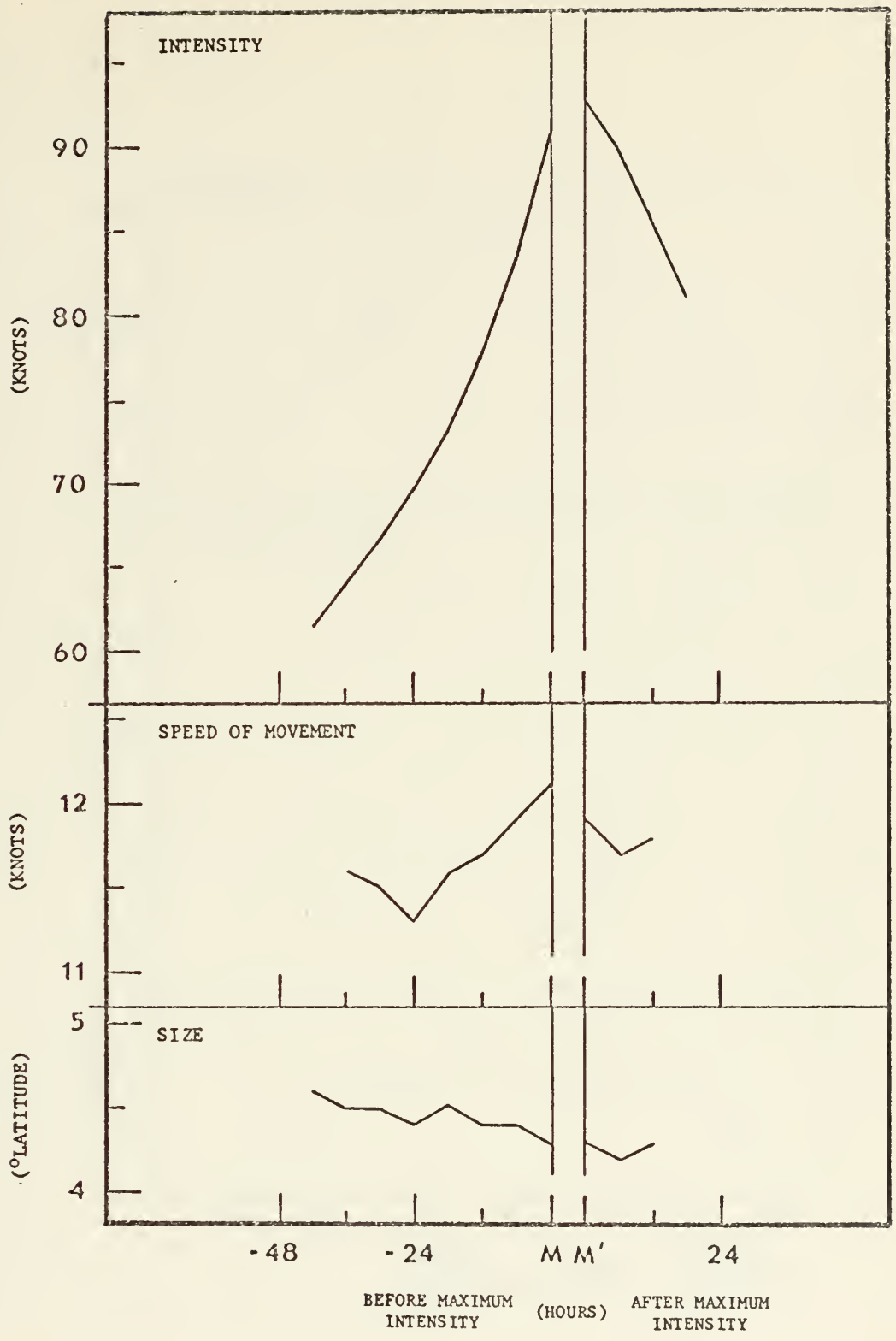


Figure 10. Comparison of the mean intensity, speed and size profiles for the east to west moving tropical cyclones (July-November, 1960-1969) relative to the point at which the storms reach their maximum intensity.

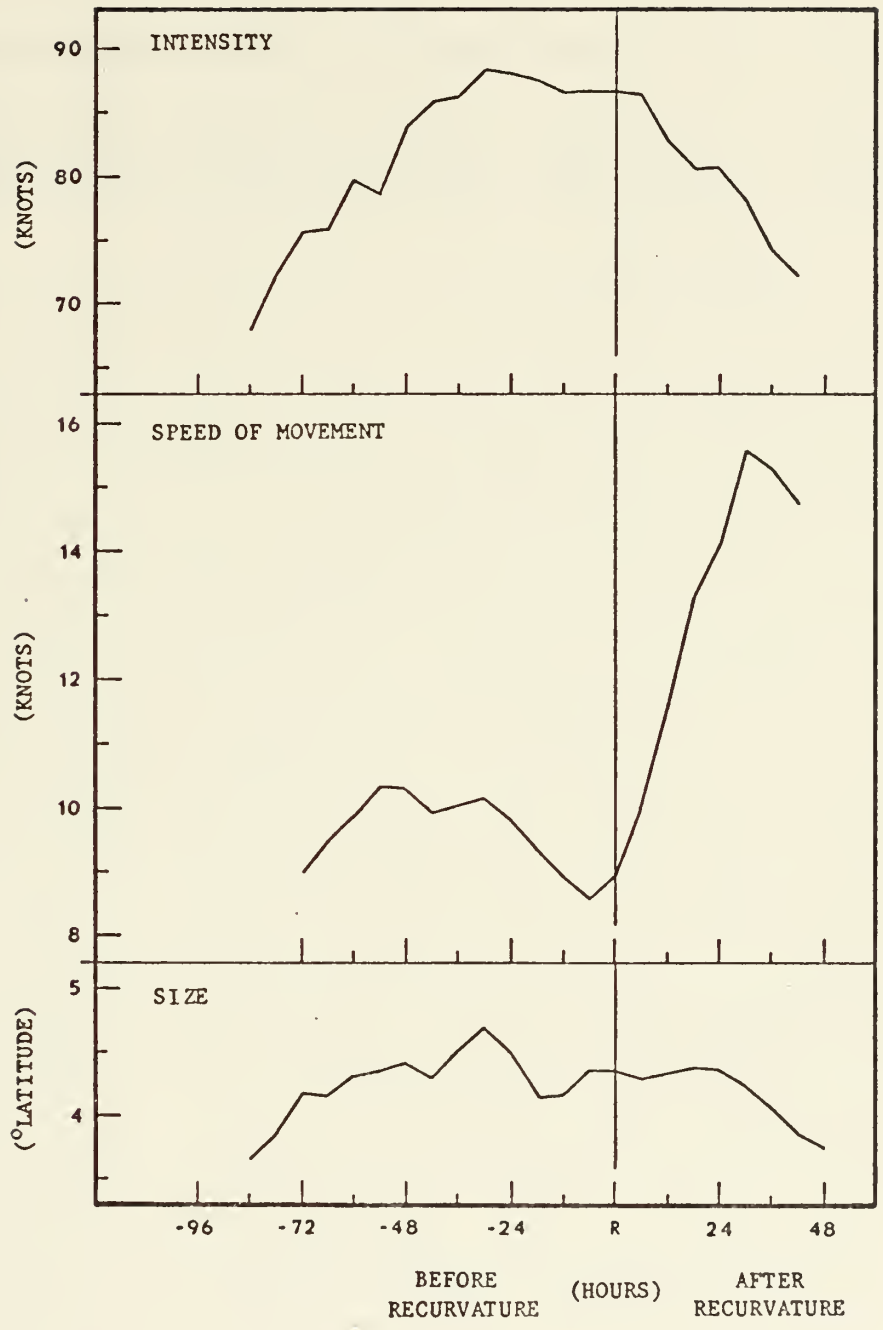


Figure 11. Comparison of the mean intensity, speed and size profiles for the recurving tropical cyclones (August-November, 1960-1969) relative to the point of recurvature.

speed of movement showed a minimum speed six hours before recurvature, with continued acceleration thereafter until the maximum speed was reached at 30 hours after recurvature. After attaining maximum size at 30 hours before recurvature, the recurving storms showed an overall decrease in size afterward, with very little variation through the time of recurvature.

## IV. STATISTICAL CALCULATIONS

The computer program used in this study for developing the tables in Appendices B and C was from the Biomedical (BMD 02R) programs [Dixon, 1966]. This program is currently on file at the Statistical Library of the W. R. Church Computer Facility at the Naval Postgraduate School.

Appendices B and C present statistical correlations for the East-West and recurving tropical storms and typhoons data examined earlier in this study. Each table lists the means, standard deviations and correlations of the eighteen available tropical cyclone parameters. The code explanations are:

| | | |
|---|---|---|
| (1) | LAT | latitude, in degrees |
| (2) | LONG | longitude, in degrees |
| (3) | 12 DIR | past 12-hour direction of movement, in degrees |
| (4) | 12 SPD | past 12-hour speed of movement, in knots |
| (5) | 24 DIR | past 24-hour direction of movement, in degrees |
| (6) | 24 SPD | past 24-hour speed of movement, in knots |
| (7) | SIZE | the average radius of the outer closed isobar, in degrees of latitude |
| (8) | 12 C SIZ | past 12-hour change of size, in degrees latitude |
| (9) | SLP | minimum observed sea-level pressure, in millibars |
| (10) | 12 C SLP | past 12-hour change in minimum sea-level pressure, in mb |
| (11) | MAX I | maximum intensity (maximum observed wind speed), in knots |
| (12) | MIN 7 HT | minimum 700-mb height, in tens of meters |

| | | |
|---|---|---|
| (13) | 7 R LT | latitude of the 700-mb ridge north of the storm, in degrees |
| (14) | 7 R HT | 700-mb height at the ridge true north of the storm, in tens of meters |
| (15) | 7 T LONG | longitude at 35N, of the nearest 700-mb trough west of the storm, in degrees |
| (16) | 7 T HT | 700-mb height at the intersection of the trough line at 35N, in tens of meters |
| (17) | 12 C I | past 12-hour change of intensity, in knots |
| (18) | 24 C I | past 24-hour change of intensity, in knots |

A. THE CORRELATION COEFFICIENT

The various measures of correlation indicate the degree of association between the various parameters. The product-moment correlation coefficient represents the degree of linear relationship between any two variables. Because the correlations are based on data over a 10-year period, the results are generally representative.

Since successive data are usually positively correlated (due to persistence), an adjustment should be made to the total number of six-hourly observations for interpretation of the significance of correlation data. Panofsky and Brier [1958] pointed out that, approximately, each observation is independent of the observation three days prior. However, within a tropical cyclone, a complete exchange of mass occurs within 24 hours. Therefore, with four six-hourly observations per day, the number of six-hourly observations (at the top of each table) must be divided by four, yielding the effective number of independent observations, N.

1. Tests of Significance of r

The only requirement for computation of the correlation coefficient, r, for a given sample is that the values of the variables in the sample be truly quantitative. A positive value of r is obtained whenever the relationship between the two variables is such that one of the variables tends to increase if the other variable increases. On the other hand, a negative value of r results whenever the relationship between the two variables is such that one of the variables tends to decrease if the other variable increases.

To test the significance of a correlation coefficient between any two of the variables, one must decide whether or not the value of r calculated from a sample is significantly different from the population value $\rho=0$. The decision is whether or not to reject the null hypothesis, $H_0$, that the value of $\rho$ is zero, and accept the alternative, $H_A$, that $\rho$ is different from zero. Table V contains the smallest values of $|r|$ that may be considered significantly different from zero for three levels of significance and for various values of N.

To illustrate the use of these statistical concepts in this study, the following example is given. Consider an observed correlation coefficient, r=.411, and a sample size[8] N=23. The test of $H_0$: $\rho=0$, $H_A$: $\rho\neq0$ is made from Table V using the values in the columns under 10%, 5%, and 1% in the row for N=23. Under 5%, the number 0.396 is tabulated. Thus there are only five chances in 100 that a value of $|r|$ larger

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[8] N is the effective number of independent data pairs.

TABLE V

Tabulation of correlation coefficients at the 10%, 5% and 1% levels of significance.

| N | 10% | 5% | 1% | N | 10% | 5% | 1% |
|---|---|---|---|---|---|---|---|
| 1 | .988 | .997 | 1.000 | 23 | .335 | .396 | .505 |
| 2 | .900 | .950 | .990 | 24 | .329 | .388 | .496 |
| 3 | .805 | .878 | .959 | 25 | .323 | .381 | .487 |
| 4 | .729 | .811 | .917 | 26 | .317 | .374 | .478 |
| 5 | .669 | .754 | .874 | 27 | .311 | .367 | .470 |
| 6 | .622 | .707 | .834 | 28 | .306 | .361 | .463 |
| 7 | .582 | .666 | .798 | 29 | .301 | .355 | .456 |
| 8 | .549 | .632 | .765 | 30 | .296 | .349 | .449 |
| 9 | .521 | .602 | .735 | 35 | .275 | .325 | .418 |
| 10 | .497 | .576 | .708 | 40 | .257 | .304 | .393 |
| 11 | .476 | .553 | .684 | 45 | .293 | .288 | .372 |
| 12 | .458 | .532 | .661 | 50 | .231 | .273 | .354 |
| 13 | .441 | .514 | .641 | 60 | .211 | .250 | .325 |
| 14 | .426 | .497 | .623 | 70 | .195 | .232 | .302 |
| 15 | .412 | .482 | .606 | 80 | .183 | .217 | .283 |
| 16 | .400 | .468 | .590 | 90 | .173 | .205 | .267 |
| 17 | .389 | .456 | .575 | 100 | .164 | .195 | .254 |
| 18 | .378 | .444 | .561 | 125 | .156 | .174 | .228 |
| 19 | .369 | .433 | .549 | 150 | .143 | .159 | .208 |
| 20 | .360 | .423 | .537 | 200 | .125 | .138 | .181 |
| 22 | .383 | .404 | .515 | 300 | .103 | .113 | .148 |

than 0.396 would occur by pure chance in drawing an independent sample of 23 observations from a population, in which there really is no linear relationship between the two variables. In other words, 0.396 is the smallest value of $|r|$ that can be considered significant at the 5% significance level for 23 independent observations of two variables. Because the observed value, 0.411, of r is larger than the value in Table V, 0.396, it is concluded that the value of r computed from the sample is significantly different from zero at the 5% significance level. Therefore, the null hypothesis $H_0$, that there is no linear relation between the two variables, is rejected.

Furthermore, notice that the tabulated value on the line for N=23 in the column under 1% is 0.505. Since the observed value of r=0.411 is less than the table value 0.505, it is concluded that the observed value is significantly different from the population value $\rho=0$ at the 10% and 5% levels of significance, but not significantly different from $\rho=0$ at the 1% level.

2. Application to 24-hour Change of Intensity

To further examine the intensity parameter, a summary of the four highest correlation coefficients of parameter 18, the past 24-hour change of intensity, was constructed. This was done as a diagnostic study to look for relationships between the parameters, and to see if these relationships are physically realistic. Tables VI, VII, VIII and IX summarizes these coefficients before and after maximum intensity for East-West storms, and before and after the time of recurvature for

recurving storms. The number within parentheses indicates the variable number, as listed in the previous section. Each correlation coefficient was tested for a 1% level of significance as described above. In those cases for which less than four variables were significant at the 1% level, additional variables were added at the 5% and 10% levels and indicated by asterisks. The correlation coefficients computed from the combined data of all months are given at the bottom of the tables for comparison.

Table VI summarizes the correlation coefficients for the East-West storms during the period before maximum intensity. As could be expected, the past 12-hour change of intensity (parameter 17) was the most frequent as well as the largest correlation coefficient. In fact, it only occurred in the column of the largest correlation coefficient in this table. In most months persistence was quite a good forecast. The explained variance from this parameter alone ranged from about 60% in April and May to 84% in October. In the column of second-largest correlations, maximum intensity (parameter 11) appeared in the five months having the greatest number of six-hourly observations. The 12-hour change in sea-level pressure (parameter 10) occurred the most number of times as the third-largest correlation coefficient, and was a negative value each time. The fourth-largest correlation coefficient column showed the minimum 700-mb height (parameter 12) to occur the most often, although the months having the greatest number of six-hourly observations favored sea-level pressure (parameter 9). Because

TABLE VI

Four highest correlation coefficients of the past 24-hour change of maximum intensity (parameter 18) for the period before maximum intensity of the East-West tropical storms and typhoons. The number in parantheses denotes the variable number listed at the beginning of Section IV.

| PERIOD | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| FEBRUARY | -0.812(10) | 0.725(8)** | | |
| MARCH | 0.840(3) | 0.828(5) | | |
| APRIL | 0.782(17) | -0.611(9)** | -0.591(12** | 0.546(11)* |
| MAY | 0.775(17) | 0.690(3) | 0.656(11) | -0.597(10)** |
| JUNE | 0.832(17) | 0.625(14) | 0.490(1)** | -0.430(7)* |
| JULY | 0.794(17) | 0.571(11) | -0.474(7) | -0.470(10,12) |
| AUGUST | 0.857(17) | 0.581(11) | -0.986(10) | -0.397(9) |
| SEPTEMBER | 0.876(17) | 0.550(11) | -0.536(10) | -0.475(9) |
| OCTOBER | 0.916(17) | 0.879(11) | -0.874(10) | -0.820(12) |
| NOVEMBER | 0.908(12) | 0.731(11) | -0.620(9) | -0.577(12) |
| ALL MONTHS | 0.846(17) | 0.593(11) | -0.491(9) | -0.487(10) |

** Significant at the 5% level.

* Significant at the 10% level.

both parameters 9 and 12 are highly correlated with the maximum observed wind speed (parameter 11), which frequently appeared as the second highest correlant, little new information is added by these two parameters.

Table VII shows a summary of the correlation coefficients for the period after maximum intensity of the East-West storms. As was the case for the period before maximum intensity, the past 12-hour change of intensity (parameter 17) occurred most often as the largest correlation coefficient. The 12-hour change of sea-level pressure (parameter 10) appeared more times than any other parameter as the second-largest correlation coefficient, and each time it was a negative value. As shown in Table VII, there were no correlation coefficients with values significant at the 1% level in the columns of the third- and fourth-largest values of r. This agrees with the results obtained in the sample for all months combined, and implies that it is more difficult to accurately forecast, by statistical methods, the intensity changes after maximum intensity.

A tabulation of the four largest correlation coefficients for the recurving storms during the period prior to recurvature is shown in Table VIII. The past 12-hour change of intensity (parameter 17) dominated the r values in the column of largest correlation coefficients, although July storm intensity change had the largest correlation coefficient of 0.985 with the storm's latitude (parameter 1). Of the second-largest correlation coefficients, the 12-hour change of sea-level pressure (parameter 10) occurred most frequently. Eight months are

TABLE VII

Four highest correlation coefficients of the past 24-hour change of maximum intensity (parameter 18) for the period after maximum intensity of the East-West tropical storms and typhoons. The number in parentheses denotes the variable number listed at the beginning of Section IV.

| PERIOD | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| JANUARY | 0.964(5)** | 0.955(3)** | -0.926(9)* | -0.920(12)* |
| FEBRUARY | 0.725(11)** | 0.682(17)** | | |
| MARCH | 0.829(3)** | 0.815(5)** | | |
| APRIL | -0.815(10)** | 0.720(11)** | 0.713(17)** | -0.693(12)** |
| MAY | 0.852(17) | | | |
| JULY | 0.780(17) | -0.461(10) | 0.326(11)** | -0.304 |
| AUGUST | 0.799(17) | -0.586(10) | 0.379(11)** | -0.320(9)** |
| SEPTEMBER | 0.738(17) | -0.326(10)** | 0.282(2) | 0.258(15)* |
| OCTOBER | 0.854(17) | -0.645(10)* | | |
| NOVEMBER | 0.742(17) | -0.563(1)** | -0.443(10)* | |
| DECEMBER | 0.973(17)** | -0.926(1)* | | |
| ALL MONTHS | 0.768(17) | -0.440(10) | 0.199(11)** | 0.182(2)** |

** Significant at the 5% level.

* Significant at the 10% level.

TABLE VIII

Four highest correlation coefficients of the past 24-hour change of maximum intensity (parameter 18) for the period before recurvature of the recurving tropical storms and typhoons. The number in parentheses denotes the variable number listed at the beginning of Section IV.

| PERIOD | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| JANUARY | 0.844(12)** | 0.836(16)** | 0.747(14)* | 0.740(17)* |
| MARCH | 0.947(17) | -0.901(10) | -0.820(13) | -0.739(1) |
| APRIL | 0.787(17) | -0.517(10)** | 0.433(16)* | |
| JUNE | 0.918(17) | -0.690(10) | -0.591(12)** | 0.586(11)** |
| JULY | 0.985(1) | -0.963(13) | -0.953(10) | -0.938(6) |
| AUGUST | 0.889(17) | -0.683(10) | -0.313(1)** | |
| SEPTEMBER | 0.867(17) | -0.592(10) | -0.477(1) | -0.334(13) |
| OCTOBER | 0.854(17) | -0.703(10) | 0.297(11) | 0.278(8)** |
| NOVEMBER | 0.866(17) | -0.603(10) | | |
| DECEMBER | 0.745(17) | -0.646(7)** | | |
| ALL MONTHS | 0.871(17) | -0.641(10) | -0.245(1) | 0.177(11) |

** Significant at the 5% level.

* Significant at the 10% level.

listed in Table VIII as having a third-largest correlation coefficient significant at least at the 10% level. It is interesting to note that none of these eight months had the same third-largest parameter. These parameters included the 700-mb ridge latitude (parameter 13), the 700-mb ridge height (parameter 14), and the 700-mb trough height (parameter 16). Also of interest is the fact that the computed values of r for all months combined during this period were significant at the 1% level.

Table IX presents the correlation coefficients for the period after recurvature of the recurving storms. Consistent with Tables VI, VII and VIII, the past 12-hour change in intensity (parameter 17) was the most recurrent parameter with the largest correlation coefficients. All values in column one were significant at the 1% level. The 12-hour change of sea-level pressure (parameter 10) appeared most often as the second-largest correlation coefficient during this period. The third-largest correlation coefficient that occurred most frequently was the latitude of the storm (parameter 1). The 700-mb ridge height (parameter 14) had the greatest number of occurrences as the fourth-largest correlation coefficient, but did not occur at the 1% level of significance. As during the period before recurvature (Table VIII), the four largest correlation coefficients for all months combined were all significant at the 1% level.

TABLE IX

Four highest correlation coefficients of the past 24-hour change of maximum intensity (parameter 18) for the period after recurvature of the recurving tropical storms and typhoons. The number in parentheses denotes the variable number listed at the beginning of Section IV.

| PERIOD | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| JANUARY | 0.856(17) | -0.820(10) | | |
| MARCH | -0.942(10) | 0.813(17)** | -0.718(12)** | -0.717(14)** |
| JUNE | 0.860(17) | -0.746(10) | -0.625(1)** | 0.576(14)* |
| JULY | -0.988(12) | -0.984(6) | -0.979(9) | -0.976(12) |
| AUGUST | 0.840(17) | -0.565(10) | -0.406(1) | 0.405(11) |
| SEPTEMBER | 0.726(17) | 0.467(12)** | -0.461(10)** | 0.436(9)* |
| OCTOBER | 0.887(17) | -0.704(10) | -0.654(1) | -0.464(6) |
| NOVEMBER | 0.766(17) | -0.616(1) | 0.578(11) | -0.568(4) |
| DECEMBER | 0.975(17) | 0.698(7) | -0.669(1) | |
| ALL MONTHS | 0.817(17) | -0.600(10) | -0.393(6) | -0.391(4) |

** Significant at the 5% level.

* Significant at the 10% level.

## V. SUMMARY AND CONCLUSIONS

Available tropical cyclone data for a 10-year period were examined. Tropical storm and typhoon tracks which were classified as East-West moving and recurving storms were subjected to the following selection criteria: (1) genesis must occur east of 125E, (2) initial observation of intensity cannot exceed 65 knots, (3) the storm must have at least a 24-hour history, (4) recurving storms can have no portion of their track west of 125E, and (5) if a storm track encountered land, all subsequent data were discontinued after the most recent observation prior to landfall. The application of the above criteria resulted in a data sample consisting only of open-ocean observations.

Analysis of the data revealed significant monthly and seasonal variations of intensity, speed of movement and size. For the East-West moving storms, August storms were the smallest (size defined as the mean radius from the center of the tropical cyclone to the outer closed surface isobar). In addition, the August storms were both less intense and faster moving than the 10-year weighted means. The most intense and fastest moving East-West tropical cyclones occurred in September. October had the largest size East-West storms. The October storms were also the least intense and slowest moving East-West storms.

The recurving storms data showed August to have the least intense, slowest moving and smallest size storms. October had the largest size recurving storms. The most intense and fastest moving recurving storms occurred in November.

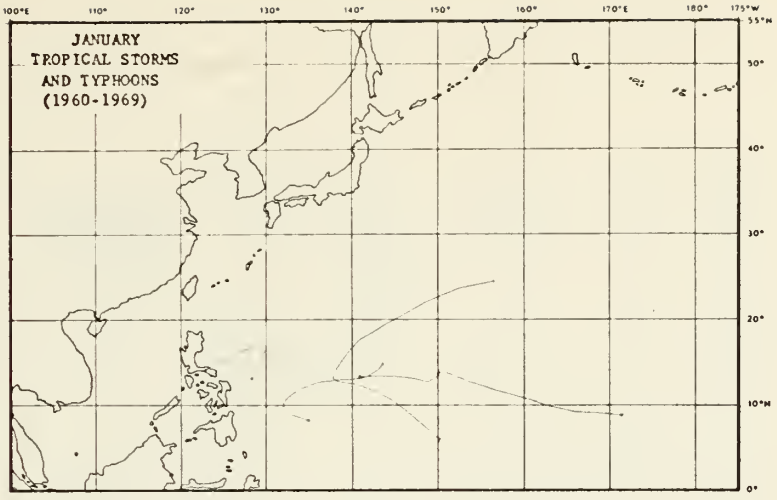
The monthly correlations between 18 parameters of tropical storm and typhoon data were computed for four composited periods: before and after maximum intensity of East-West storms, and before and after recurvature for recurving storms. In particular the correlation coefficients of the past 24-hour change of intensity were examined. The four highest correlation values for each monthly period were checked for significance at the 1%, 5%, and 10% levels. Persistence was shown to be a dominant factor in the East-West storms, with very high significance. In those months in which the storms develop and decay more rapidly, the effective contribution of persistence was less, as expected. It was then that various other parameters appeared as significant correlates.

Further study of intensity changes of the tropical cyclones is suggested. By using a similar data base to correlate current values and tendencies in the tropical cyclone parameters with subsequent intensity changes, regression equations could be developed. The information gained would be of great usefulness to the tropical meteorologist who presently has limited aids to forecast tropical cyclone development and decay.

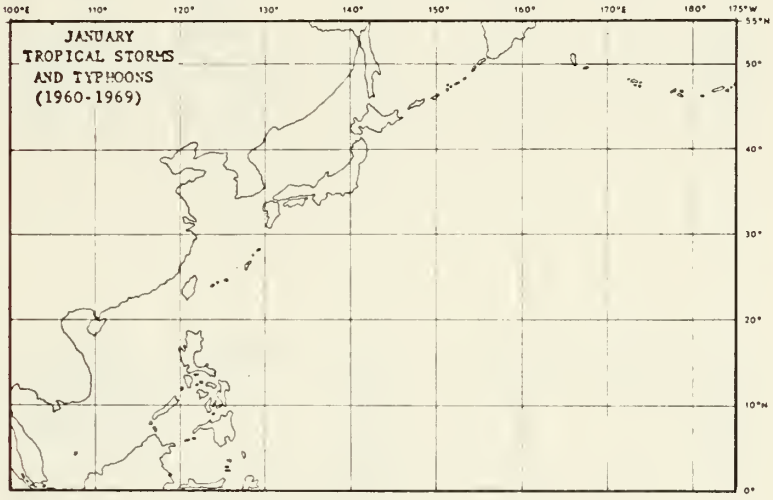
# APPENDIX A

Tracks of the tropical storms and typhoons during the period 1960 through 1969 are presented by monthly and half-monthly periods. Complete tracks of ten years storm data are compared with the East-West and recurving storms used in this study.

(a)




(b)




(c)

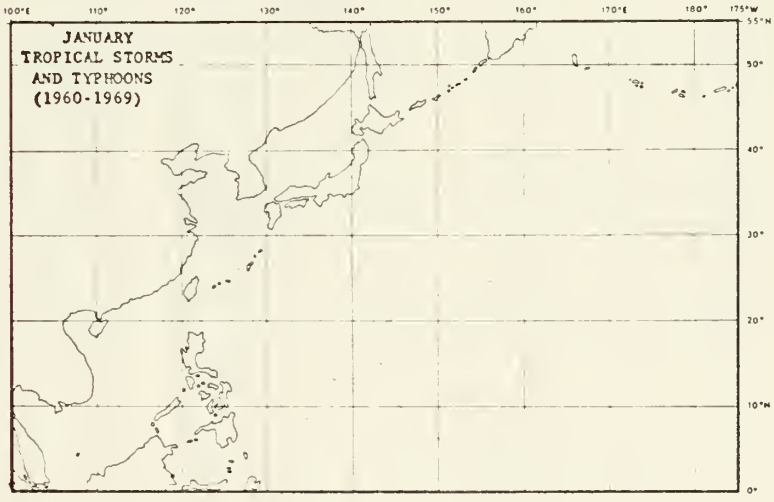
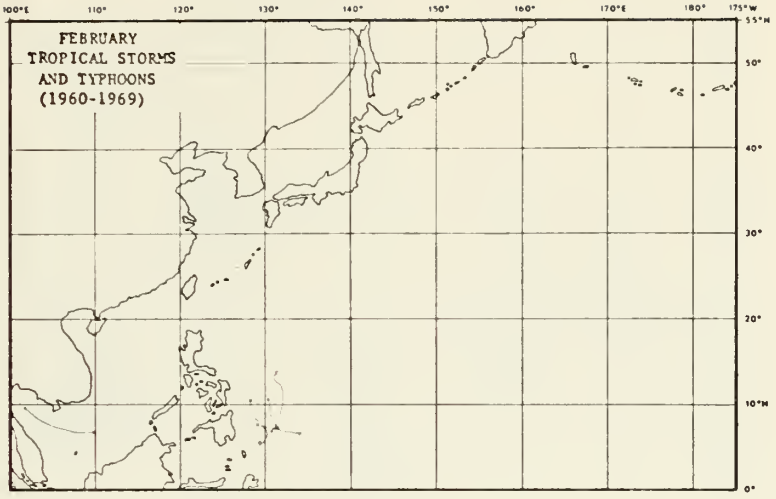



Figure 12. January tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)

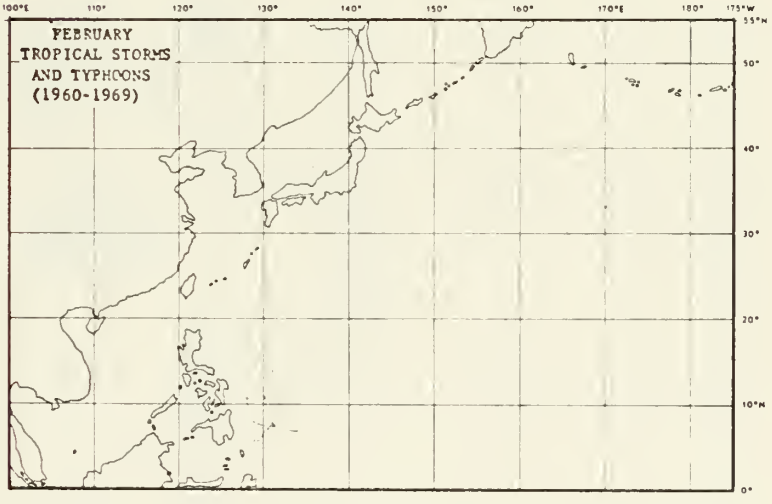
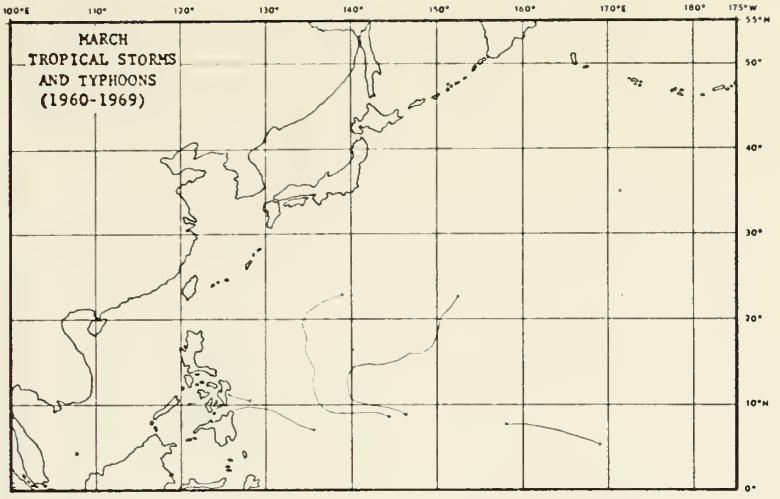
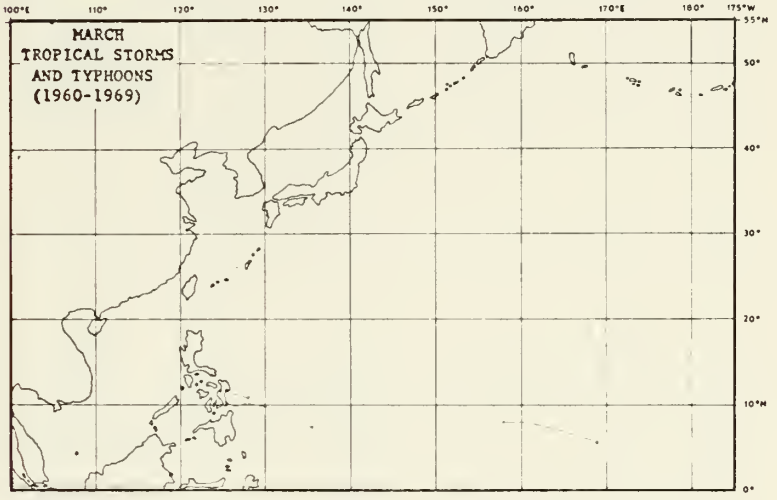



Figure 13. February tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) and the track segments of East-West storms (b) examined in this study.

(a)




(b)




(c)

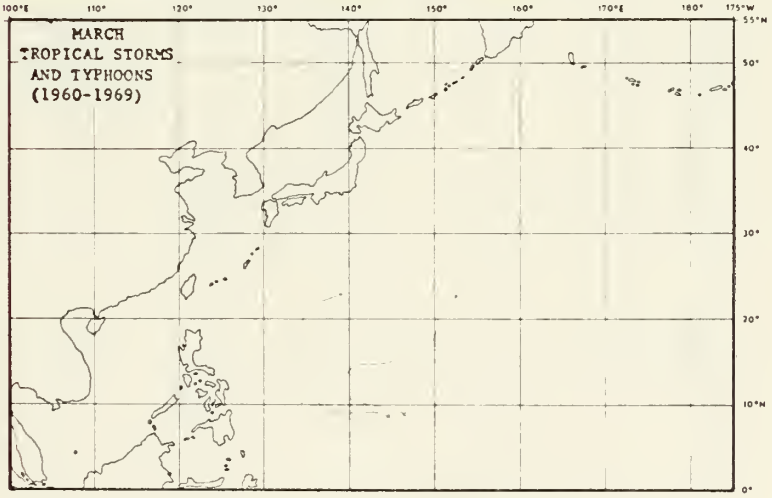
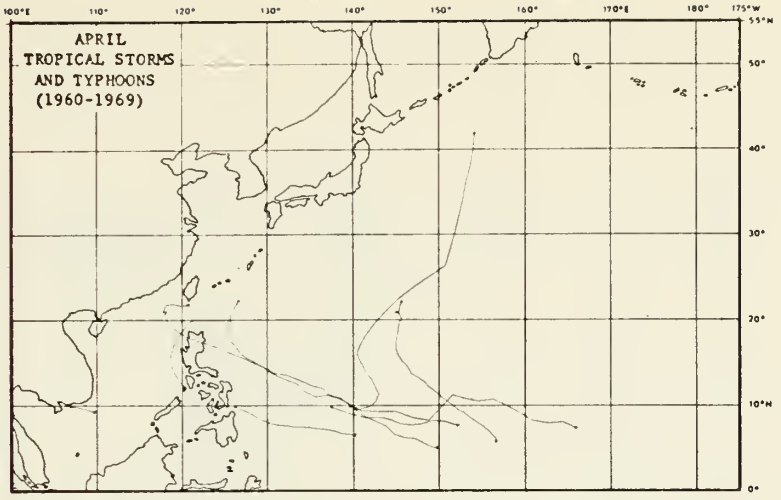
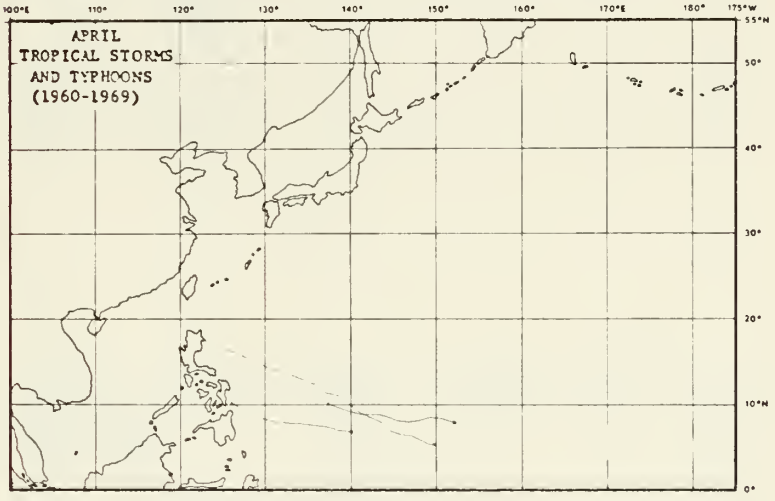



Figure 14. March tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)




(c)

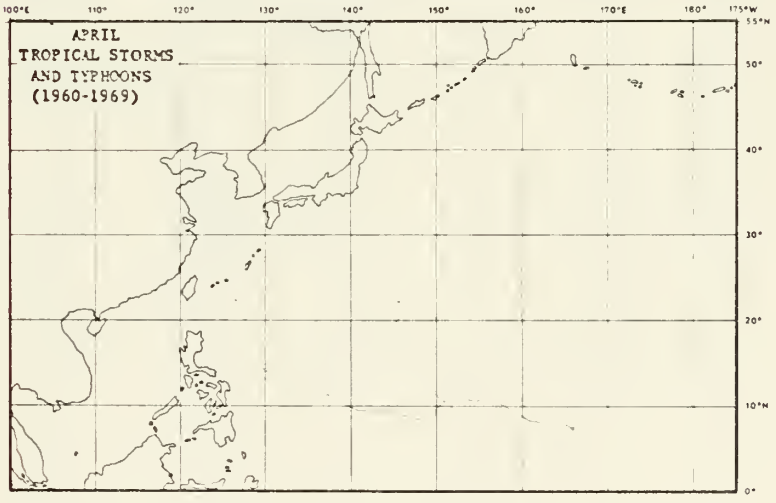
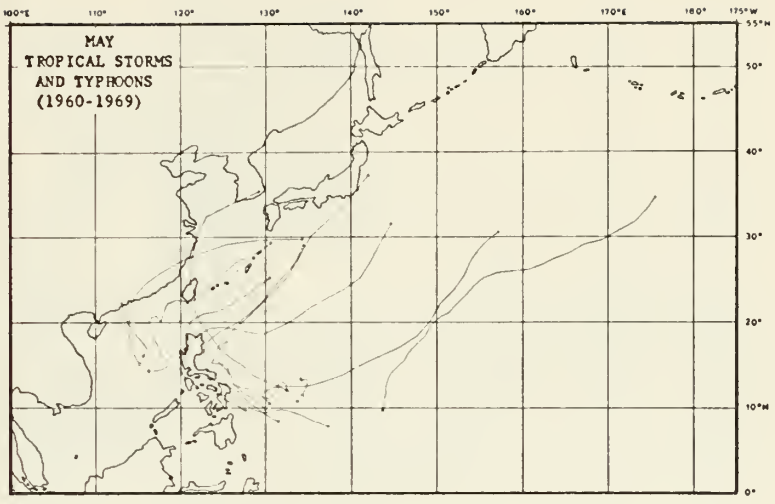



Figure 15. April tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)

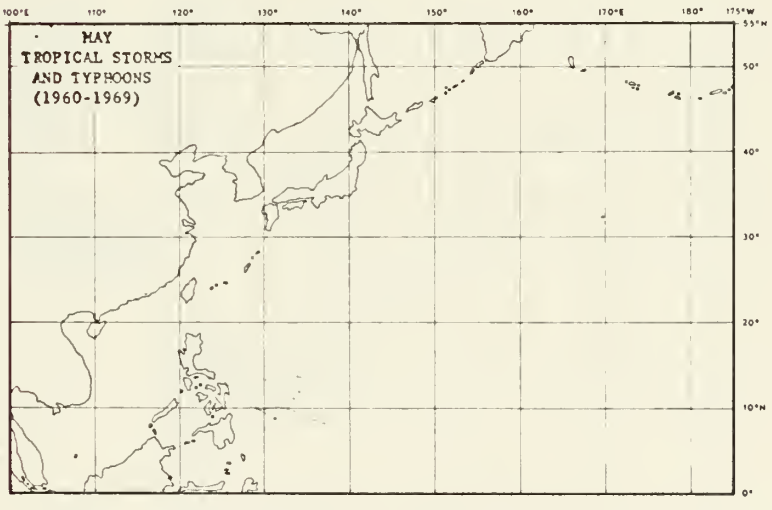
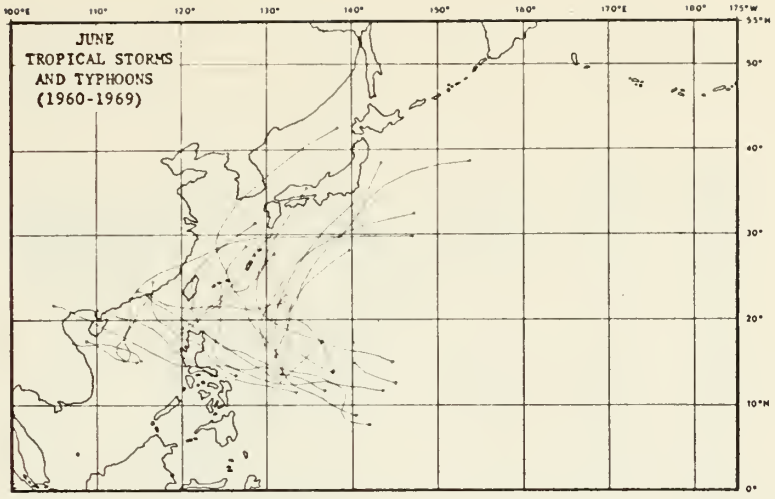
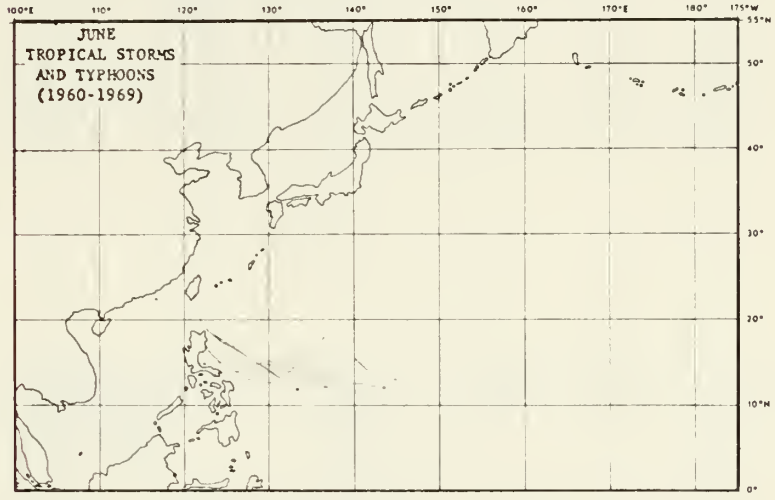



Figure 16. May tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) and the track segments of East-West storms (b) examined in this study.

(a)




(b)




(c)

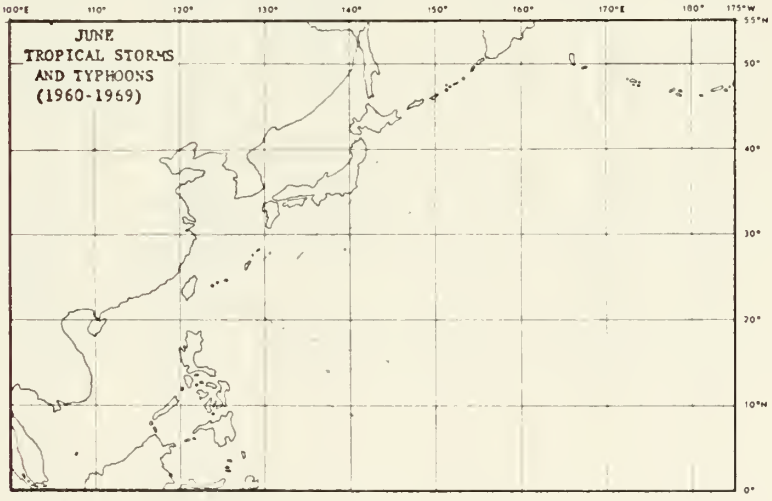
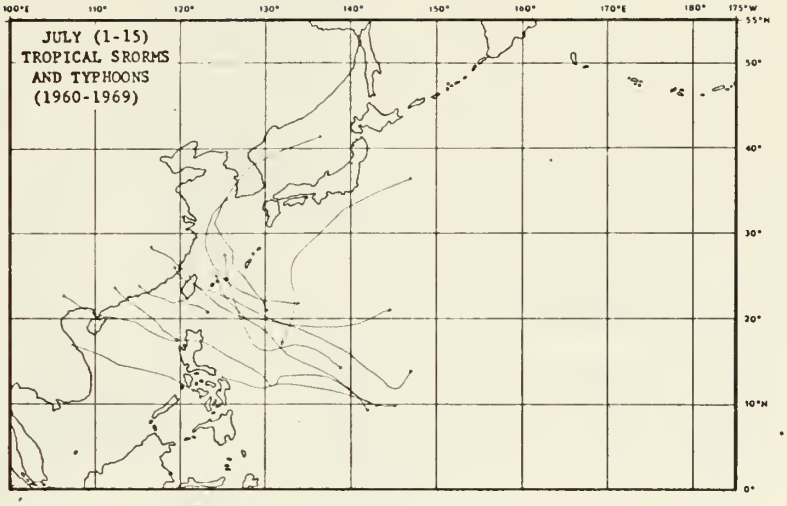



Figure 17. June tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)

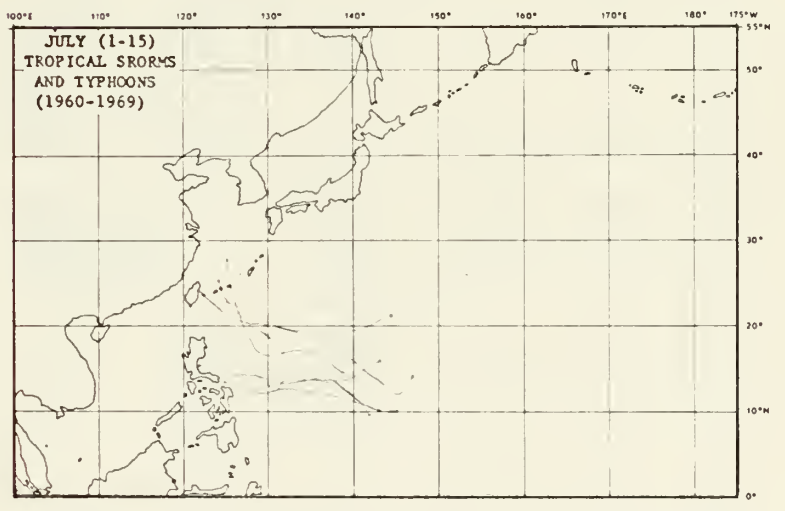
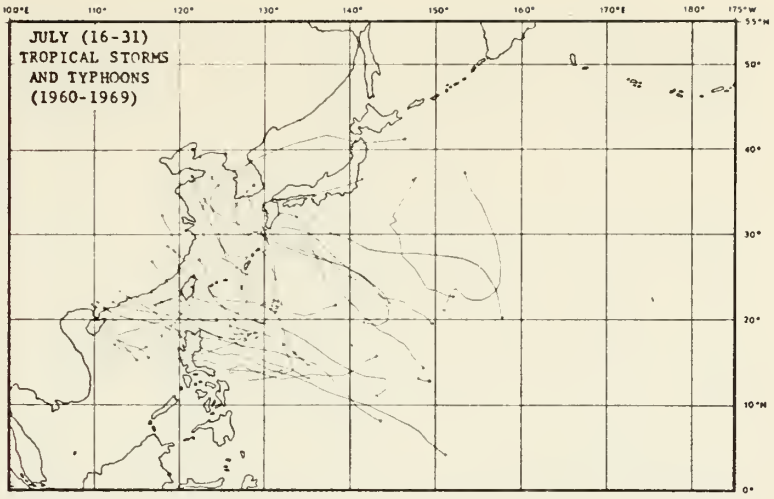
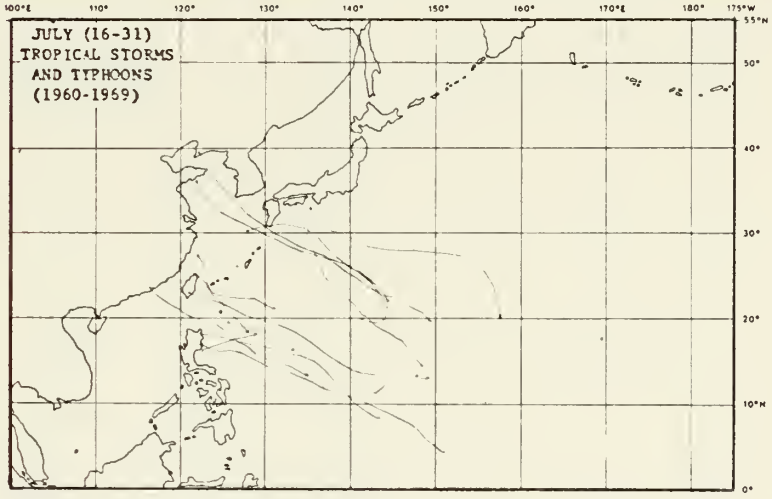



Figure 18. July (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) and the track segments of East-West storms (b) examined in this study.

(a)




(b)




(c)

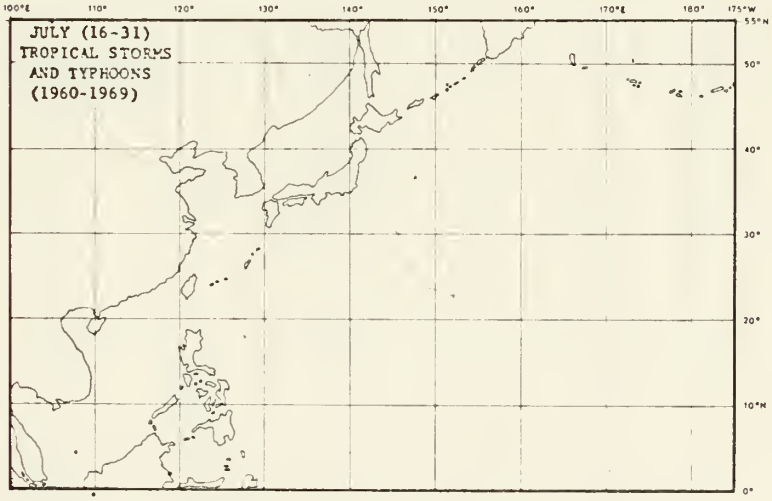
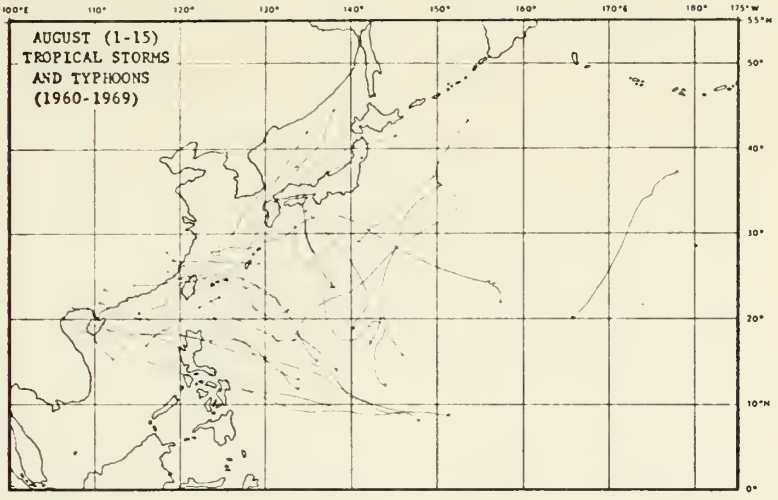
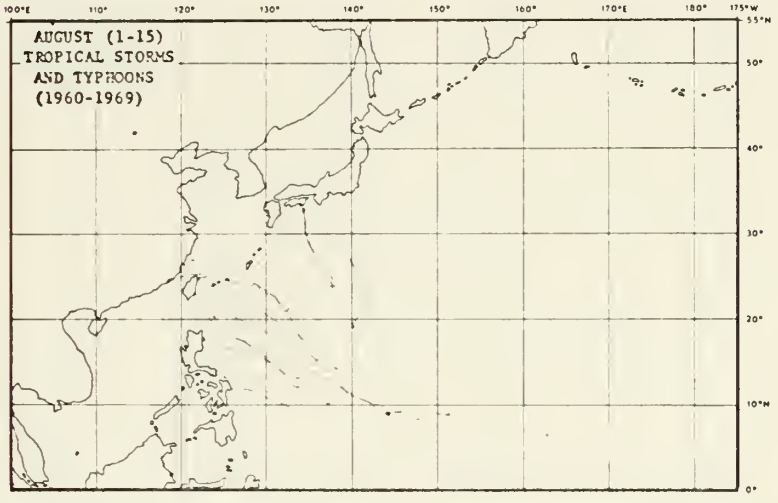



Figure 19. July (16-31) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)




(c)

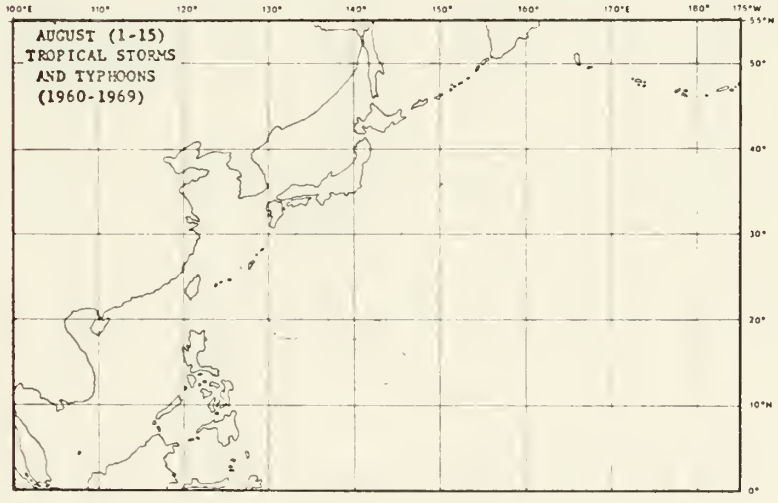



Figure 20. August (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

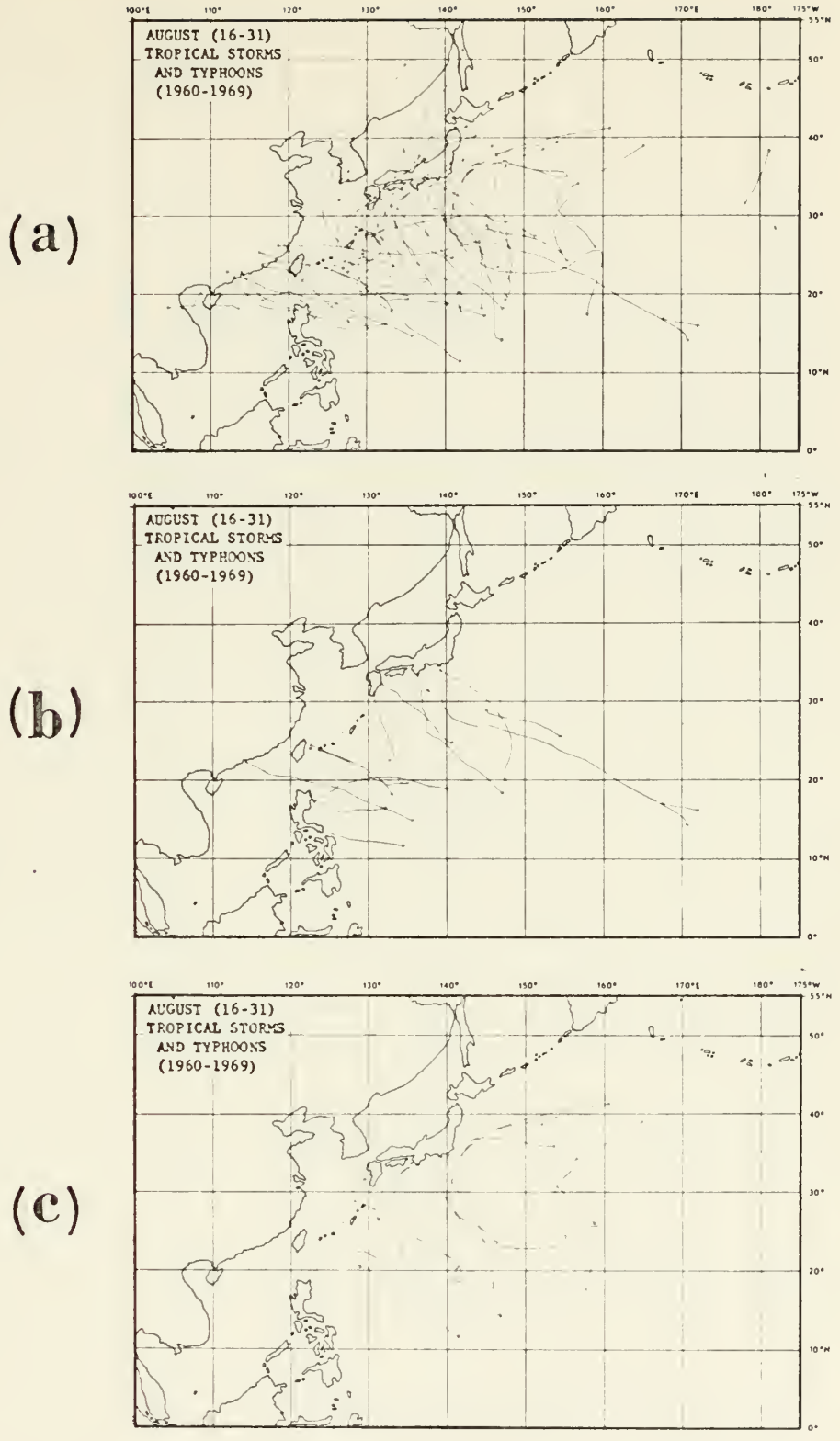



Figure 21. August (16-31) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

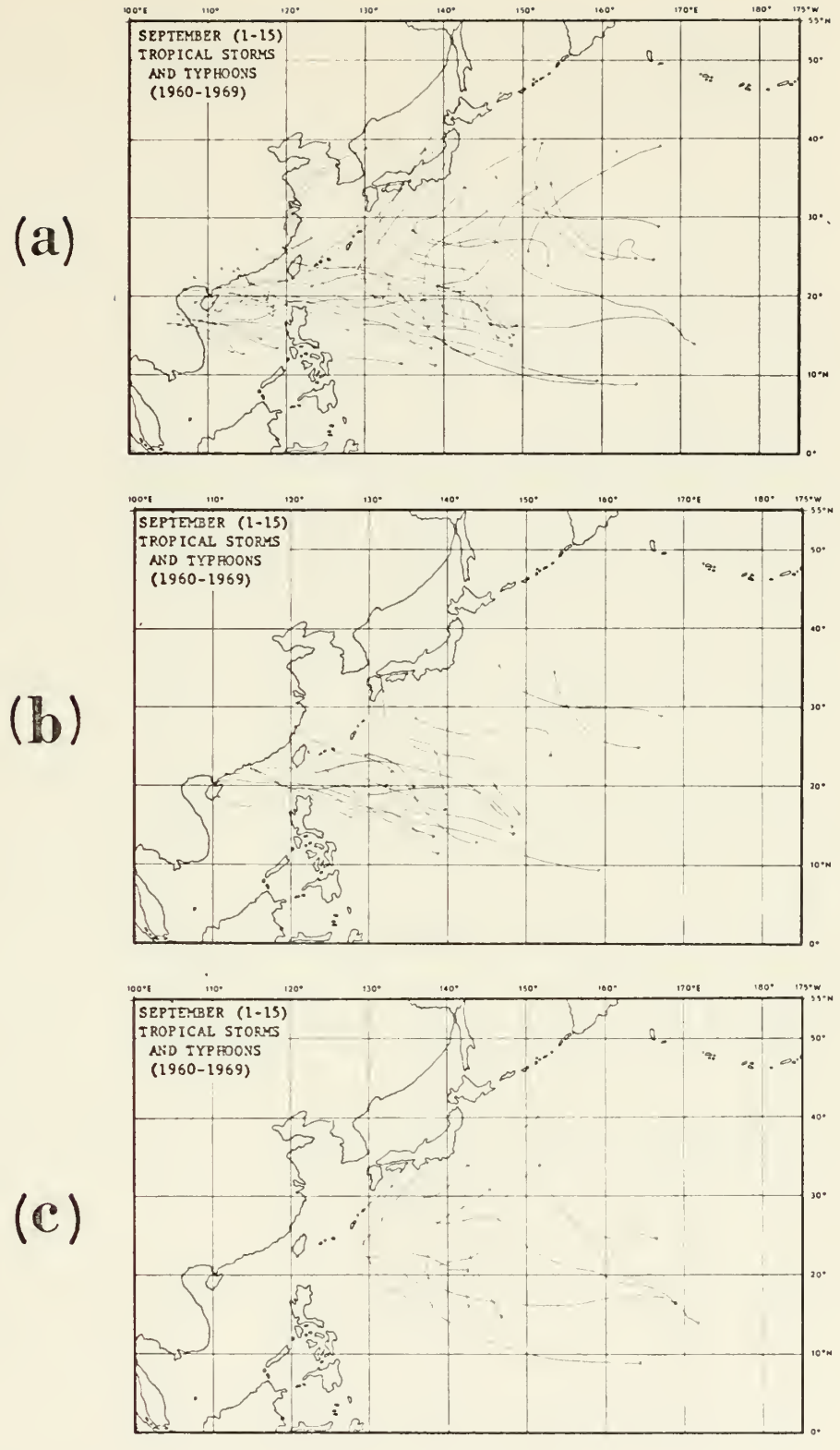
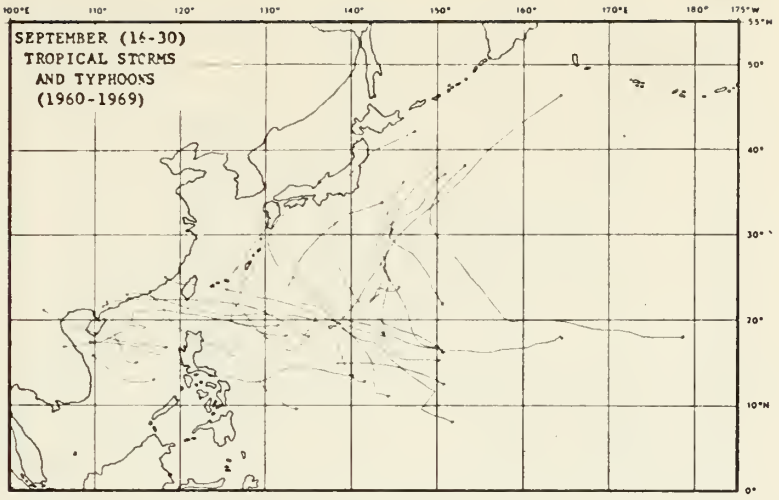
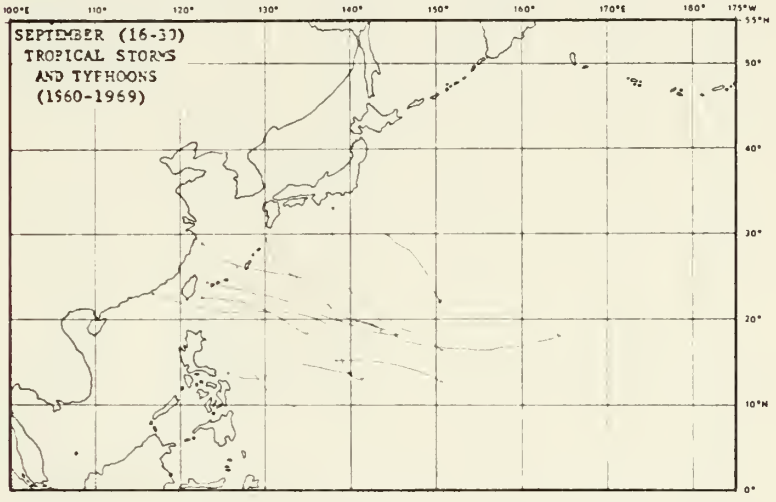



Figure 22. September (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)




(c)

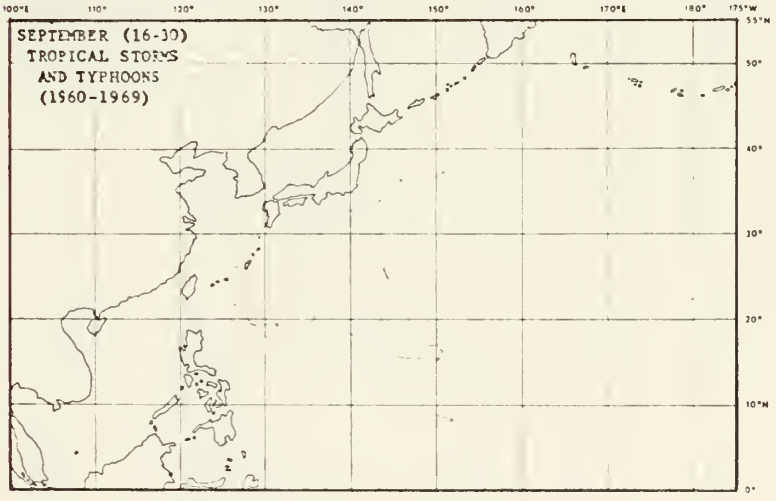
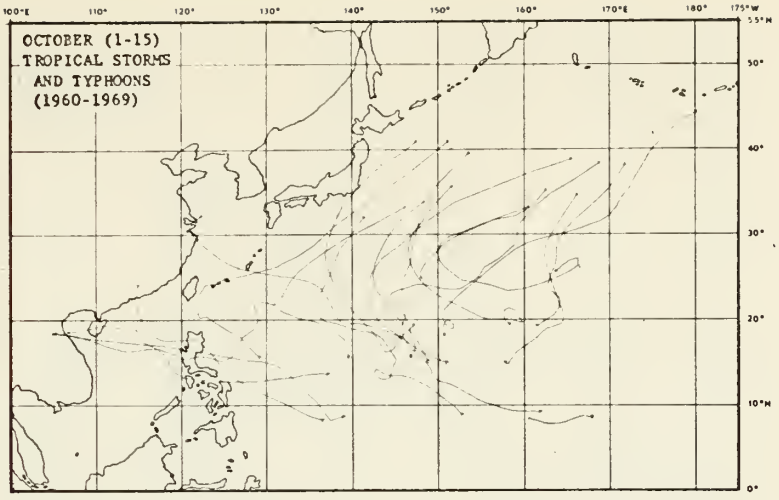
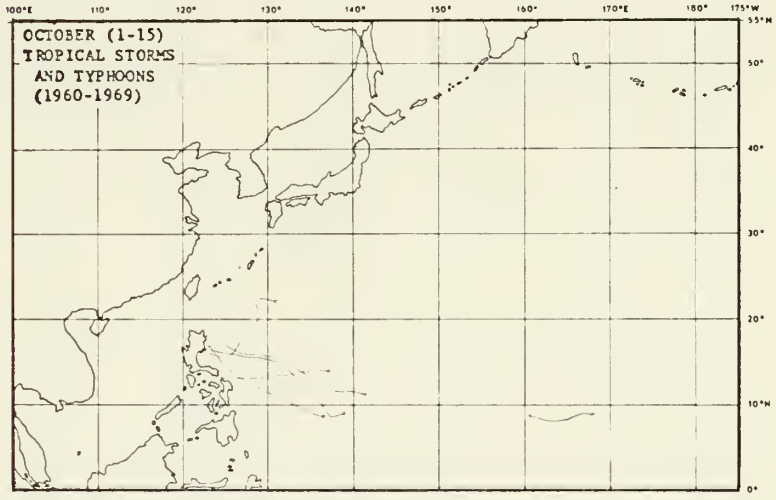



Figure 23. September (16-30) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)




(c)

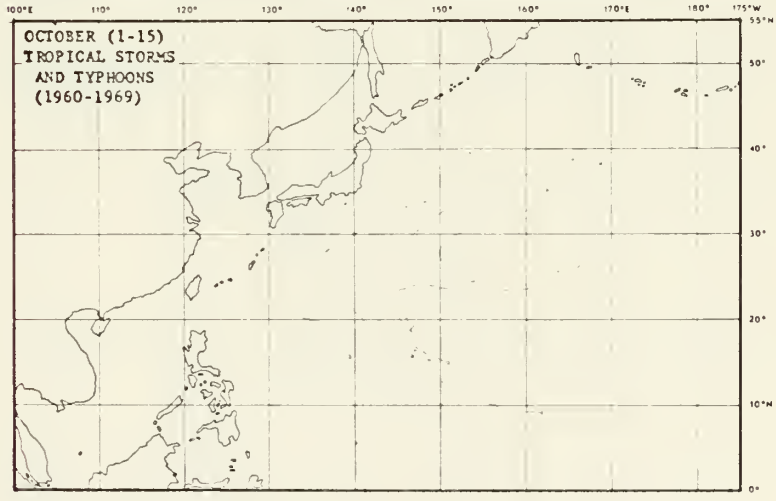
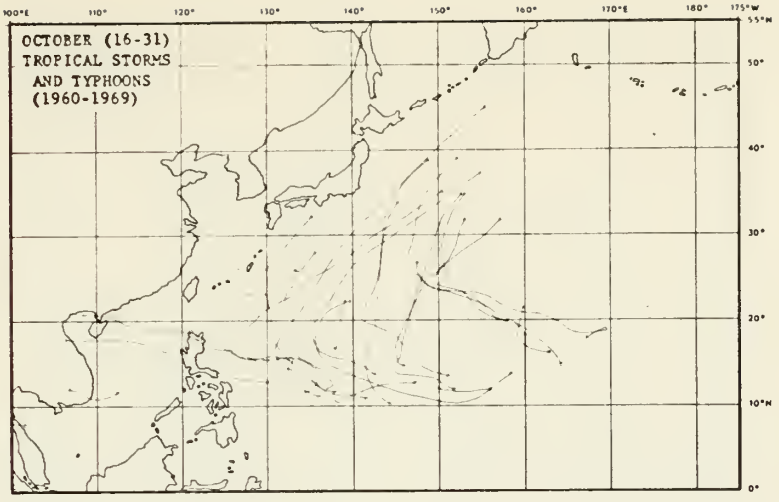
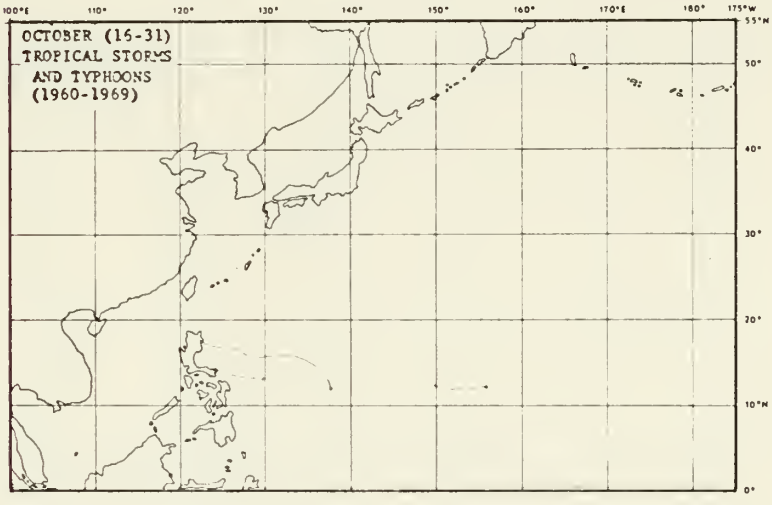



Figure 24. October (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)




(c)

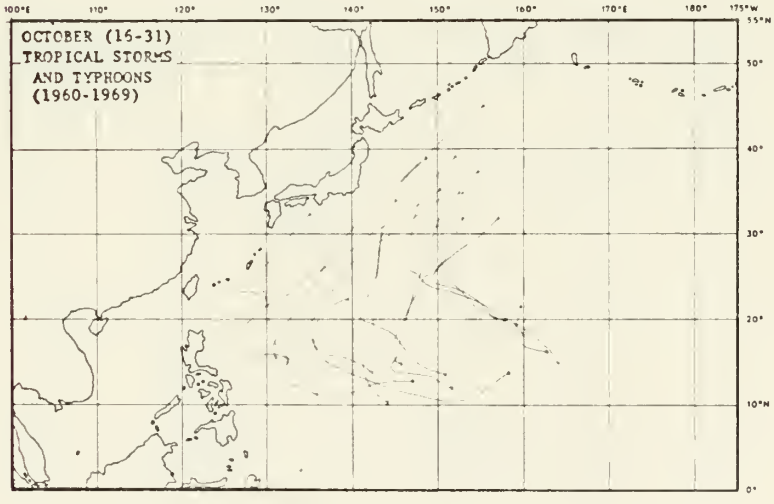
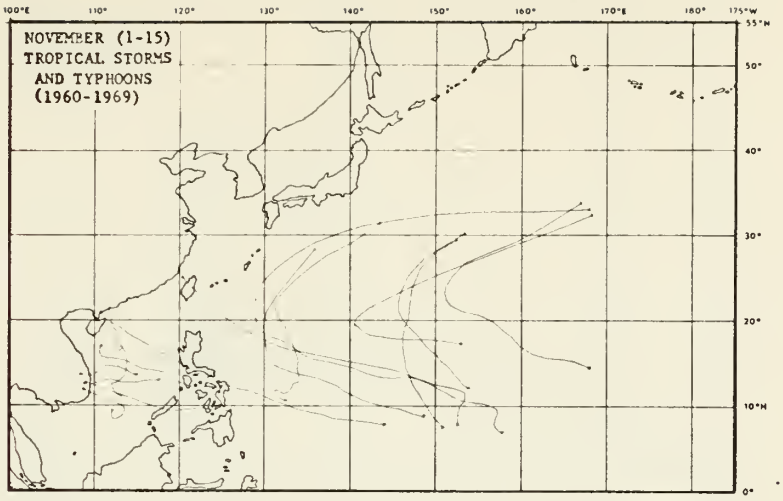
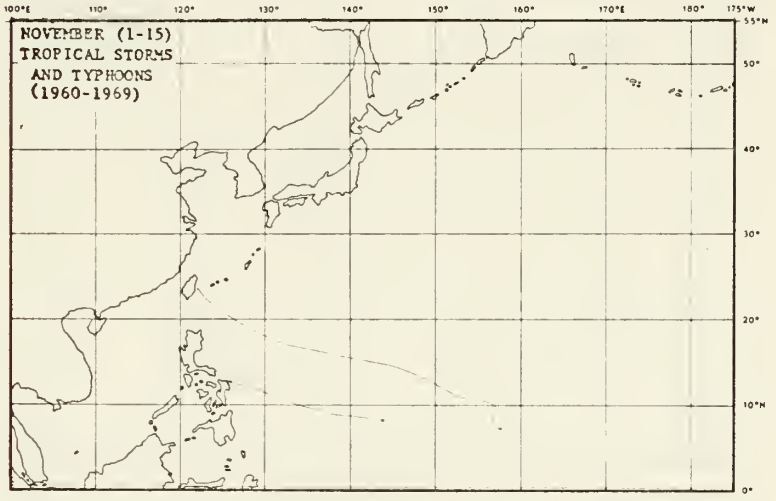



Figure 25. October (16-31) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)




(c)

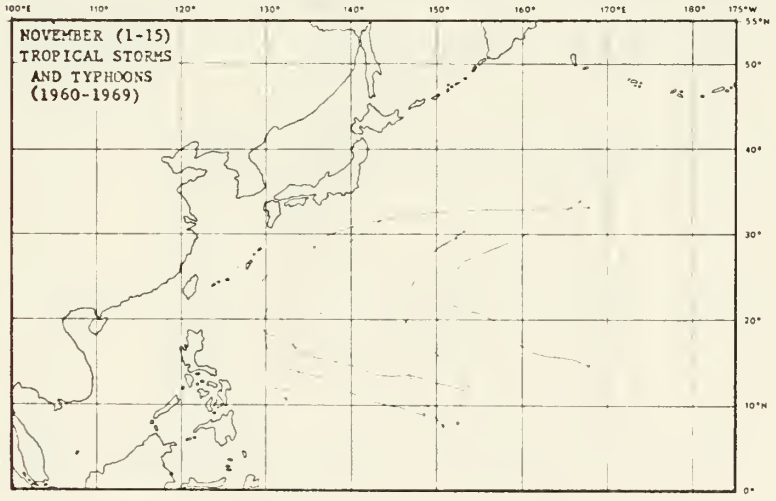
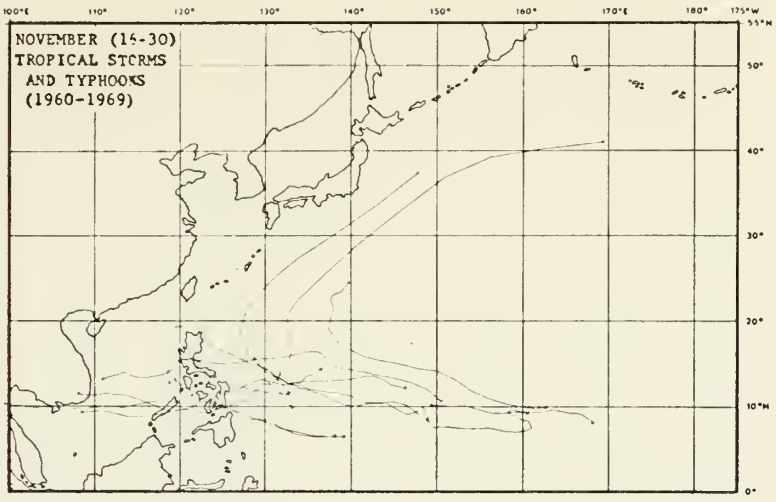
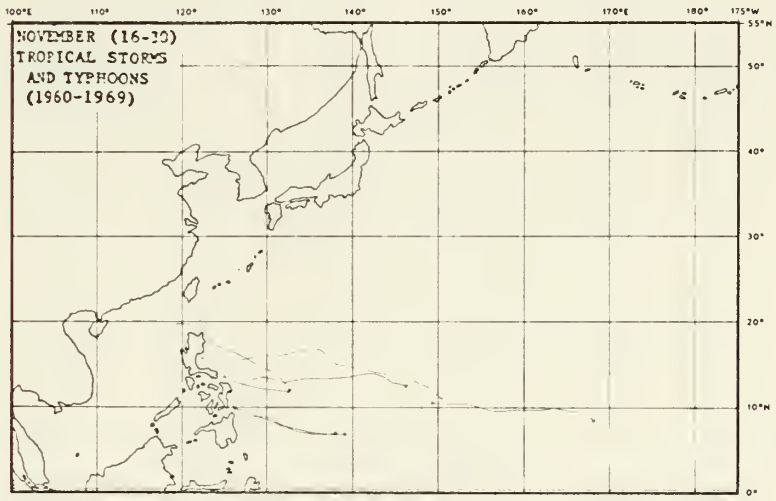



Figure 26. November (1-15) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)




(c)

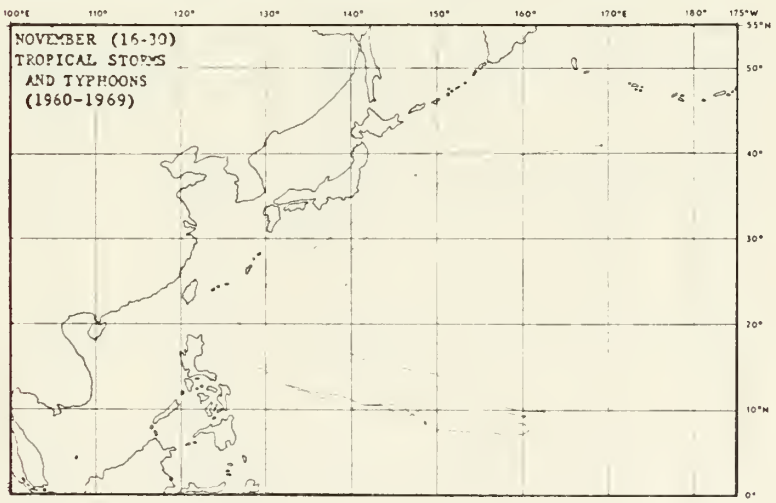
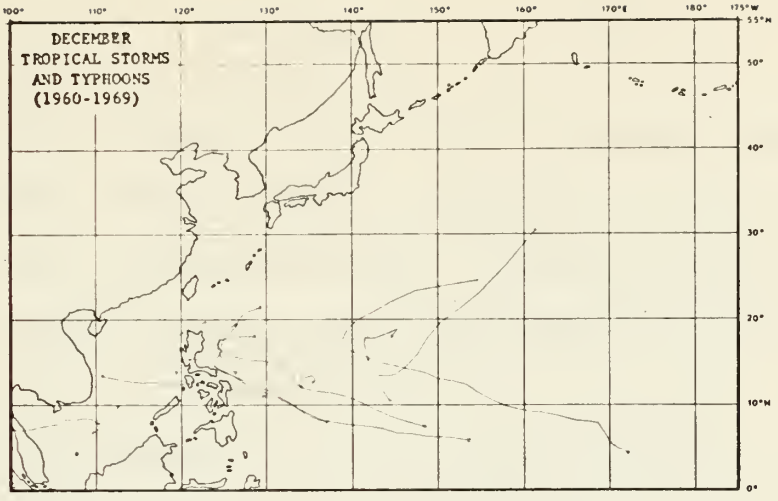
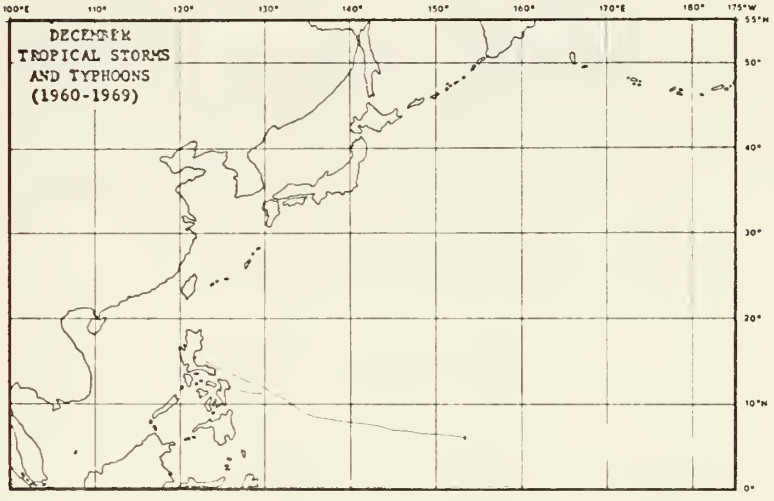



Figure 27. November (16-30) tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

(a)




(b)




(c)

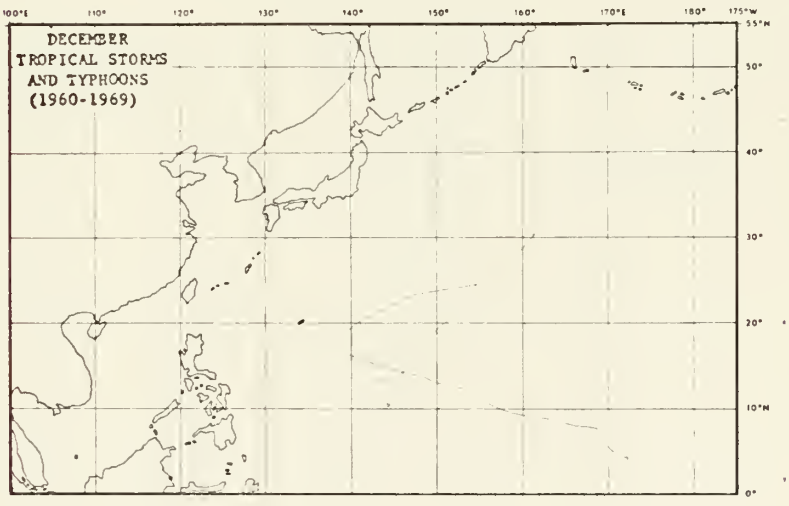



Figure 28. December tracks of tropical cyclones. Complete tracks of all tropical storms and typhoons during 1960-1969 (a) are separated into the track segments of East-West storms (b) and recurving storms (c) examined in this study.

# APPENDIX B

Statistical calculations of the 18 available parameters of the East-West moving tropical storms and typhoons during the period 1960-1969 are presented. Computations are shown for the two composited periods of the East-West storms: before and after maximum intensity.

Each table presents: (1) the number of tropical storms and typhoons for the period, (2) the number of six-hourly observations during the period, (3) the means and standard deviations of the 18 parameters, and (4) a correlation matrix of the 18 variables.

Number of East-West Tropical Storms and Typhoons: 114

Number of 6-Hourly Observations: 1277

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 16.60562 | 5.40795 | 12 C SLP | 10 | -6.75216 | 8.38279 |
| LONG | 2 | 134.97919 | 9.32066 | MAX I | 11 | 77.39211 | 33.04066 |
| 12 DIR | 3 | 293.55347 | 28.85039 | MIN 7 HT | 12 | 286.39087 | 21.85344 |
| 12 SPD | 4 | 11.14920 | 4.26670 | 7 R LT | 13 | 28.76572 | 5.10727 |
| 24 DIR | 5 | 293.04932 | 29.32910 | 7 R HT | 14 | 316.68042 | 2.50971 |
| 24 SPD | 6 | 10.86313 | 4.09859 | 7 T LONG | 15 | 119.09247 | 10.67886 |
| SIZE | 7 | 4.65845 | 1.78689 | 7 T HT | 16 | 308.45491 | 4.26153 |
| 12 C SIZ | 8 | 0.08261 | 1.03602 | 12 C I | 17 | 11.24044 | 9.79933 |
| SLP | 9 | 973.06274 | 25.21660 | 24 C I | 18 | 21.50554 | 16.11357 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.115 | 0.248 | 0.113 | 0.276 | 0.092 | -0.164 | -0.057 | -0.204 | -0.034 | 0.170 | -0.189 | 0.631 | -0.136 | -0.145 | 0.311 | 0.025 | 0.018 |
| 2 | | 1.000 | 0.110 | 0.062 | 0.118 | -0.019 | 0.020 | 0.098 | 0.166 | 0.049 | -0.195 | 0.151 | 0.151 | 0.444 | 0.448 | -0.073 | -0.071 | -0.057 |
| 3 | | | 1.000 | -0.046 | 0.856 | -0.095 | -0.064 | -0.003 | -0.109 | -0.071 | 0.079 | -0.095 | 0.277 | 0.021 | 0.036 | -0.017 | 0.070 | 0.071 |
| 4 | | | | 1.000 | 0.022 | 0.941 | -0.065 | -0.071 | 0.021 | -0.041 | 0.106 | 0.050 | 0.055 | 0.264 | -0.121 | 0.093 | 0.062 | 0.118 |
| 5 | | | | | 1.000 | -0.036 | -0.081 | 0.002 | -0.085 | -0.058 | 0.067 | -0.072 | 0.287 | 0.053 | 0.044 | 0.020 | 0.070 | 0.070 |
| 6 | | | | | | 1.000 | -0.049 | -0.045 | -0.039 | -0.073 | 0.158 | -0.006 | 0.023 | 0.252 | -0.167 | 0.089 | 0.064 | 0.126 |
| 7 | | | | | | | 1.000 | 0.382 | -0.207 | -0.074 | 0.152 | -0.235 | 0.043 | 0.030 | 0.071 | 0.080 | 0.045 | 0.069 |
| 8 | | | | | | | | 1.000 | 0.014 | -0.003 | -0.055 | 0.002 | 0.018 | 0.072 | 0.037 | 0.021 | -0.043 | -0.024 |
| 9 | | | | | | | | | 1.000 | 0.557 | -0.861 | 0.978 | -0.109 | 0.033 | 0.115 | -0.066 | -0.413 | -0.491 |
| 10 | | | | | | | | | | 1.000 | -0.390 | 0.519 | -0.035 | -0.084 | 0.110 | -0.080 | -0.520 | -0.487 |
| 11 | | | | | | | | | | | 1.000 | -0.841 | 0.074 | -0.000 | -0.141 | 0.037 | 0.487 | 0.593 |
| 12 | | | | | | | | | | | | 1.000 | -0.105 | 0.029 | 0.093 | -0.065 | -0.393 | -0.463 |
| 13 | | | | | | | | | | | | | 1.000 | 0.193 | 0.062 | 0.300 | 0.085 | 0.075 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.049 | 0.153 | 0.107 | 0.137 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.053 | -0.092 | -0.110 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.066 | 0.076 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.846 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE X. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons for all months (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 114

Number of 6-Hourly Observations: 698

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 20.60457 | 6.85451 | 12 C SLP | 10 | 3.32319 | 8.18365 |
| LONG | 2 | 130.46576 | 9.82602 | MAX I | 11 | 74.53477 | 41.44125 |
| 12 DIR | 3 | 297.24487 | 32.03293 | MIN 7 HT | 12 | 283.46069 | 24.66219 |
| 12 SPD | 4 | 10.43478 | 4.27617 | 7 R LT | 13 | 30.47391 | 6.00784 |
| 24 DIR | 5 | 297.14038 | 28.71144 | 7 R HT | 14 | 315.53760 | 2.43566 |
| 24 SPD | 6 | 10.24928 | 3.94930 | 7 T LONG | 15 | 116.03477 | 14.21540 |
| SIZE | 7 | 4.27536 | 2.05781 | 7 T HT | 16 | 307.93311 | 15.99199 |
| 12 C SIZ | 8 | -0.14203 | 1.01228 | 12 C I | 17 | -6.33768 | 10.68967 |
| SLP | 9 | 971.03027 | 28.86295 | 24 C I | 18 | -5.81739 | 18.81728 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.014 | 0.293 | 0.204 | 0.331 | 0.224 | -0.083 | -0.075 | -0.130 | 0.088 | 0.103 | -0.100 | 0.844 | -0.261 | 0.085 | 0.073 | -0.093 | -0.144 |
| 2 | | 1.000 | 0.083 | 0.084 | 0.115 | 0.053 | -0.102 | 0.097 | 0.219 | -0.175 | -0.199 | 0.125 | 0.070 | 0.369 | 0.522 | -0.029 | 0.160 | 0.182 |
| 3 | | | 1.000 | -0.071 | 0.825 | -0.113 | -0.162 | -0.010 | 0.046 | 0.097 | -0.015 | 0.045 | 0.098 | -0.194 | 0.085 | -0.005 | -0.062 | -0.046 |
| 4 | | | | 1.000 | -0.070 | 0.940 | 0.147 | 0.066 | -0.095 | 0.031 | 0.125 | -0.088 | 0.218 | 0.259 | 0.072 | 0.026 | -0.012 | 0.083 |
| 5 | | | | | 1.000 | -0.117 | -0.140 | 0.019 | 0.039 | 0.076 | -0.031 | 0.046 | 0.117 | -0.211 | 0.115 | -0.008 | -0.056 | -0.035 |
| 6 | | | | | | 1.000 | 0.167 | 0.044 | -0.118 | 0.056 | 0.151 | -0.107 | 0.244 | 0.264 | 0.049 | 0.054 | -0.050 | 0.033 |
| 7 | | | | | | | 1.000 | 0.283 | -0.479 | 0.025 | 0.417 | -0.498 | 0.103 | 0.015 | 0.005 | 0.045 | 0.102 | 0.054 |
| 8 | | | | | | | | 1.000 | -0.056 | 0.008 | 0.043 | -0.057 | -0.022 | 0.082 | 0.129 | 0.050 | 0.001 | 0.032 |
| 9 | | | | | | | | | 1.000 | -0.044 | -0.905 | 0.989 | -0.163 | 0.085 | 0.071 | 0.003 | -0.044 | -0.134 |
| 10 | | | | | | | | | | 1.000 | 0.111 | -0.047 | 0.048 | -0.191 | -0.056 | 0.021 | -0.455 | -0.440 |
| 11 | | | | | | | | | | | 1.000 | -0.895 | 0.113 | -0.078 | -0.055 | -0.003 | 0.061 | 0.199 |
| 12 | | | | | | | | | | | | 1.000 | -0.145 | 0.076 | 0.061 | 0.005 | -0.059 | -0.152 |
| 13 | | | | | | | | | | | | | 1.000 | -0.113 | 0.105 | 0.097 | -0.054 | -0.094 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.072 | 0.086 | 0.067 | 0.118 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.556 | 0.046 | 0.044 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.026 | -0.073 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.768 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons for all months (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 1

Number of 6-Hourly Observations: 7

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 15.44368 | 0.43055 | 12 C SLP | 10 | -2.12059 | 4.69159 |
| LONG | 2 | 129.89627 | 0.81187 | MAX I | 11 | 55.07861 | 7.15137 |
| 12 DIR | 3 | 385.25049 | 8.39827 | MIN 7 HT | 12 | 302.04395 | 0.22495 |
| 12 SPD | 4 | 5.82079 | 0.28442 | 7 R LT | 13 | 25.55096 | 0.60266 |
| 24 DIR | 5 | 387.92993 | 4.10666 | 7 R HT | 14 | 313.15503 | 0.53969 |
| 24 SPD | 6 | 4.58095 | 0.04087 | 7 T LONG | 15 | 116.68687 | 5.51886 |
| SIZE | 7 | 4.48234 | 0.92494 | 7 T HT | 16 | 304.27515 | 1.28618 |
| 12 C SIZ | 8 | -0.02065 | 1.03093 | 12 C I | 17 | 12.15989 | 2.45832 |
| SLP | 9 | 992.12842 | 1.96367 | 24 C I | 18 | 26.94537 | 2.09973 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.114 | 0.277 | 0.125 | 0.308 | 0.126 | -0.143 | -0.096 | -0.166 | 0.184 | 0.113 | -0.152 | 0.752 | -0.253 | -0.046 | 0.095 | -0.230 | -0.245 |
| 2 | | 1.000 | 0.080 | 0.089 | 0.097 | 0.031 | -0.018 | 0.119 | 0.196 | -0.165 | -0.182 | 0.192 | 0.102 | 0.439 | 0.496 | -0.027 | 0.181 | 0.191 |
| 3 | | | 1.000 | -0.063 | 0.840 | -0.107 | -0.120 | -0.013 | -0.031 | 0.039 | 0.025 | -0.027 | 0.189 | -0.093 | 0.055 | -0.008 | -0.037 | -0.030 |
| 4 | | | | 1.000 | -0.026 | 0.941 | 0.048 | 0.000 | -0.033 | -0.050 | 0.118 | -0.013 | 0.122 | 0.273 | -0.008 | 0.038 | 0.074 | 0.130 |
| 5 | | | | | 1.000 | -0.077 | -0.115 | 0.002 | -0.027 | 0.038 | 0.014 | -0.019 | 0.210 | -0.079 | 0.071 | -0.003 | -0.038 | -0.029 |
| 6 | | | | | | 1.000 | 0.063 | 0.003 | -0.074 | -0.053 | 0.155 | -0.049 | 0.117 | 0.267 | -0.044 | 0.055 | 0.057 | 0.109 |
| 7 | | | | | | | 1.000 | 0.340 | -0.345 | -0.073 | 0.300 | -0.364 | 0.059 | 0.044 | 0.045 | 0.049 | 0.121 | 0.109 |
| 8 | | | | | | | | 1.000 | -0.016 | -0.054 | -0.001 | -0.019 | -0.018 | 0.099 | 0.097 | 0.039 | 0.054 | 0.070 |
| 9 | | | | | | | | | 1.000 | 0.206 | -0.881 | 0.984 | -0.142 | 0.065 | 0.094 | -0.009 | -0.145 | -0.214 |
| 10 | | | | | | | | | | 1.000 | -0.145 | 0.176 | 0.084 | -0.226 | -0.044 | -0.017 | -0.654 | -0.631 |
| 11 | | | | | | | | | | | 1.000 | -0.865 | 0.089 | -0.030 | -0.085 | 0.005 | 0.220 | 0.318 |
| 12 | | | | | | | | | | | | 1.000 | -0.134 | 0.064 | 0.082 | -0.008 | -0.127 | -0.196 |
| 13 | | | | | | | | | | | | | 1.000 | 0.006 | 0.014 | 0.119 | -0.090 | -0.106 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.086 | 0.091 | 0.211 | 0.236 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.405 | 0.067 | 0.058 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.014 | -0.012 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.882 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during January (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 1

Number of 6-Hourly Observations: 11

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 15.88181 | 1.00081 | 12 C SLP | 10 | 1.27273 | 2.83164 |
| LONG | 2 | 126.29079 | 2.49247 | MAX I | 11 | 46.36363 | 15.82575 |
| 12 DIR | 3 | 273.72705 | 49.74551 | MIN 7 HT | 12 | 307.27271 | 2.53341 |
| 12 SPD | 4 | 7.27273 | 1.84883 | 7 R LT | 13 | 23.18181 | 1.25045 |
| 24 DIR | 5 | 285.72705 | 54.11855 | 7 R HT | 14 | 312.63623 | 1.12006 |
| 24 SPD | 6 | 6.81818 | 1.99089 | 7 T LONG | 15 | 105.36363 | 8.00340 |
| SIZE | 7 | 2.81818 | 0.87386 | 7 T HT | 16 | 302.90894 | 1.13618 |
| 12 C SIZ | 8 | -0.45455 | 0.52223 | 12 C I | 17 | -6.81818 | 5.80908 |
| SLP | 9 | 996.54541 | 2.97871 | 24 C I | 18 | -9.09091 | 15.78261 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.954 | 0.623 | -0.456 | 0.767 | -0.780 | 0.853 | -0.362 | -0.570 | 0.309 | 0.952 | -0.487 | 0.922 | -0.890 | 0.027 | 0.148 | 0.398 | 0.622 |
| 2 | | 1.000 | 0.822 | -0.577 | 0.916 | -0.794 | 0.940 | -0.242 | -0.739 | 0.265 | 0.988 | -0.684 | 0.937 | -0.965 | 0.272 | 0.261 | 0.588 | 0.811 |
| 3 | | | 1.000 | -0.625 | 0.957 | -0.569 | 0.871 | 0.037 | -0.886 | -0.004 | 0.796 | -0.910 | 0.707 | -0.851 | 0.578 | 0.355 | 0.794 | 0.955 |
| 4 | | | | 1.000 | -0.725 | 0.776 | -0.709 | -0.169 | 0.678 | -0.188 | -0.595 | 0.644 | -0.370 | 0.536 | -0.170 | -0.892 | -0.592 | -0.798 |
| 5 | | | | | 1.000 | -0.753 | 0.942 | -0.037 | -0.906 | 0.088 | 0.908 | -0.879 | 0.780 | -0.907 | 0.444 | 0.465 | 0.791 | 0.964 |
| 6 | | | | | | 1.000 | -0.826 | 0.105 | 0.524 | -0.487 | -0.785 | 0.427 | -0.568 | 0.730 | -0.033 | -0.627 | -0.359 | -0.678 |
| 7 | | | | | | | 1.000 | 0.020 | -0.765 | 0.265 | 0.924 | -0.743 | 0.857 | -0.892 | 0.296 | 0.385 | 0.611 | 0.883 |
| 8 | | | | | | | | 1.000 | -0.018 | 0.092 | -0.220 | -0.048 | -0.167 | 0.373 | 0.378 | 0.092 | 0.166 | 0.116 |
| 9 | | | | | | | | | 1.000 | 0.277 | -0.781 | 0.972 | -0.566 | 0.725 | -0.399 | -0.486 | -0.957 | -0.926 |
| 10 | | | | | | | | | | 1.000 | 0.192 | 0.309 | 0.408 | -0.218 | 0.203 | 0.102 | -0.335 | 0.039 |
| 11 | | | | | | | | | | | 1.000 | -0.709 | 0.921 | -0.928 | 0.225 | 0.286 | 0.652 | 0.815 |
| 12 | | | | | | | | | | | | 1.000 | -0.522 | 0.708 | -0.454 | -0.442 | -0.925 | -0.920 |
| 13 | | | | | | | | | | | | | 1.000 | -0.876 | 0.322 | 0.013 | 0.454 | 0.675 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.318 | -0.264 | -0.554 | -0.800 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.037 | 0.509 | 0.504 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.429 | 0.563 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.854 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during January (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 22

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 7.49999 | 3.46237 | 12 C SLP | 10 | -2.00000 | 1.26491 |
| LONG | 2 | 129.81656 | 1.51452 | MAX I | 11 | 39.16666 | 4.91596 |
| 12 DIR | 3 | 211.50000 | 112.36324 | MIN 7 HT | 12 | 300.83325 | 3.31159 |
| 12 SPD | 4 | 4.00000 | 2.19089 | 7 R LT | 13 | 13.66667 | 4.92612 |
| 24 DIR | 5 | 227.00000 | 105.27296 | 7 R HT | 14 | 316.33325 | 1.86190 |
| 24 SPD | 6 | 2.83333 | 1.47196 | 7 T LONG | 15 | 128.00000 | 2.60768 |
| SIZE | 7 | 3.00000 | 0.89443 | 7 T HT | 16 | 300.16650 | 5.98052 |
| 12 C SIZ | 8 | -0.16667 | 0.98319 | 12 C I | 17 | 2.50000 | 4.18330 |
| SLP | 9 | 993.83325 | 4.53505 | 24 C I | 18 | 5.83333 | 5.84523 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.971 | -0.423 | 0.749 | -0.470 | 0.883 | 0.846 | -0.311 | 0.972 | -0.247 | -0.670 | 0.986 | 0.989 | -0.974 | 0.445 | -0.942 | 0.442 | -0.133 |
| 2 | | 1.000 | -0.299 | 0.856 | -0.335 | 0.917 | 0.723 | -0.441 | 0.892 | -0.209 | -0.508 | 0.930 | 0.939 | -0.988 | 0.633 | -0.972 | 0.592 | -0.171 |
| 3 | | | 1.000 | 0.219 | 0.986 | -0.049 | -0.499 | -0.017 | -0.536 | 0.173 | 0.647 | -0.404 | -0.492 | 0.424 | -0.005 | 0.363 | 0.169 | 0.285 |
| 4 | | | | 1.000 | 0.198 | 0.868 | 0.408 | -0.557 | 0.604 | 0.0 | -0.186 | 0.717 | 0.667 | -0.784 | 0.700 | -0.824 | 0.655 | -0.156 |
| 5 | | | | | 1.000 | -0.130 | -0.595 | -0.122 | -0.581 | 0.320 | 0.640 | -0.450 | -0.552 | 0.449 | 0.038 | 0.361 | 0.098 | 0.135 |
| 6 | | | | | | 1.000 | 0.760 | -0.161 | 0.774 | -0.430 | -0.299 | 0.855 | 0.873 | -0.851 | 0.521 | -0.814 | 0.731 | 0.136 |
| 7 | | | | | | | 1.000 | 0.227 | 0.888 | -0.530 | -0.682 | 0.878 | 0.908 | -0.721 | 0.000 | -0.636 | 0.267 | 0.191 |
| 8 | | | | | | | | 1.000 | -0.232 | -0.643 | 0.172 | -0.256 | -0.179 | 0.473 | -0.702 | 0.584 | -0.211 | 0.725 |
| 9 | | | | | | | | | 1.000 | -0.209 | -0.815 | 0.983 | 0.973 | -0.916 | 0.254 | -0.876 | 0.237 | -0.145 |
| 10 | | | | | | | | | | 1.000 | -0.161 | -0.191 | -0.353 | 0.170 | 0.061 | 0.0 | -0.567 | -0.812 |
| 11 | | | | | | | | | | | 1.000 | -0.747 | -0.674 | 0.583 | 0.156 | 0.584 | 0.365 | 0.377 |
| 12 | | | | | | | | | | | | 1.000 | 0.977 | -0.930 | 0.324 | -0.907 | 0.325 | -0.146 |
| 13 | | | | | | | | | | | | | 1.000 | -0.945 | 0.374 | -0.894 | 0.437 | -0.058 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.618 | 0.982 | -0.514 | 0.245 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.667 | 0.733 | -0.394 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.460 | 0.396 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.307 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XIV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during February (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 26

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 8.71923 | 1.28125 | 12 C SLP | 10 | 1.26923 | 1.97094 |
| LONG | 2 | 129.91144 | 1.20245 | MAX I | 11 | 33.84625 | 8.03836 |
| 12 DIR | 3 | 295.65381 | 69.76926 | MIN 7 HT | 12 | 306.76904 | 6.12736 |
| 12 SPD | 4 | 6.07692 | 1.76461 | 7 R LT | 13 | 15.76923 | 5.99538 |
| 24 DIR | 5 | 295.46143 | 76.10942 | 7 R HT | 14 | 315.23071 | 2.43816 |
| 24 SPD | 6 | 5.73077 | 1.51149 | 7 T LONG | 15 | 107.07692 | 5.19170 |
| SIZE | 7 | 2.92308 | 0.68836 | 7 T HT | 16 | 303.42285 | 3.48910 |
| 12 C SIZ | 8 | 0.07692 | 0.93480 | 12 C I | 17 | -3.65385 | 5.75459 |
| SLP | 9 | 1000.19214 | 8.27535 | 24 C I | 18 | -2.88461 | 9.18401 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.059 | -0.040 | -0.599 | -0.136 | -0.495 | 0.047 | -0.409 | 0.332 | 0.003 | -0.493 | 0.332 | -0.070 | -0.319 | 0.037 | 0.097 | -0.074 | -0.230 |
| 2 | | 1.000 | -0.659 | 0.271 | -0.644 | 0.213 | 0.465 | -0.022 | 0.275 | -0.351 | 0.152 | 0.174 | 0.707 | -0.594 | 0.462 | -0.590 | 0.414 | 0.494 |
| 3 | | | 1.000 | -0.484 | 0.987 | -0.590 | -0.027 | 0.194 | 0.104 | 0.272 | -0.201 | 0.219 | -0.769 | 0.218 | -0.467 | 0.398 | -0.208 | -0.287 |
| 4 | | | | 1.000 | -0.435 | 0.863 | -0.094 | 0.215 | -0.316 | -0.167 | 0.387 | -0.387 | 0.406 | 0.144 | 0.231 | -0.350 | 0.186 | 0.372 |
| 5 | | | | | 1.000 | -0.544 | -0.065 | 0.186 | 0.030 | 0.235 | -0.104 | 0.147 | -0.780 | 0.276 | -0.501 | 0.423 | -0.177 | -0.234 |
| 6 | | | | | | 1.000 | -0.136 | 0.213 | -0.194 | 0.012 | 0.270 | -0.283 | 0.465 | 0.072 | 0.405 | -0.455 | -0.003 | 0.316 |
| 7 | | | | | | | 1.000 | 0.507 | 0.628 | -0.073 | -0.342 | 0.612 | 0.364 | -0.704 | 0.539 | -0.569 | -0.175 | -0.037 |
| 8 | | | | | | | | 1.000 | 0.101 | 0.097 | 0.066 | 0.080 | -0.025 | -0.026 | 0.073 | -0.243 | -0.169 | 0.190 |
| 9 | | | | | | | | | 1.000 | 0.330 | -0.787 | 0.985 | 0.360 | -0.902 | 0.721 | -0.685 | -0.371 | -0.271 |
| 10 | | | | | | | | | | 1.000 | -0.497 | 0.356 | 0.087 | -0.013 | 0.135 | 0.023 | -0.527 | -0.486 |
| 11 | | | | | | | | | | | 1.000 | -0.826 | -0.205 | 0.575 | -0.549 | 0.296 | 0.683 | 0.725 |
| 12 | | | | | | | | | | | | 1.000 | 0.281 | -0.845 | 0.663 | -0.583 | -0.399 | -0.378 |
| 13 | | | | | | | | | | | | | 1.000 | -0.535 | 0.760 | -0.628 | -0.002 | -0.020 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.795 | 0.820 | 0.162 | 0.022 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.856 | -0.338 | -0.184 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.120 | -0.223 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.682 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during February (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 3

Number of 6-Hourly Observations: 13

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 8.08235 | 1.51667 | 12 C SLP | 10 | 2.11765 | 4.34284 |
| LONG | 2 | 150.32933 | 17.59666 | MAX I | 11 | 43.82352 | 15.66539 |
| 12 DIR | 3 | 283.23511 | 8.12041 | MIN 7 HT | 12 | 305.52930 | 6.81099 |
| 12 SPD | 4 | 11.41176 | 2.57533 | 7 R LT | 13 | 21.94116 | 1.71284 |
| 24 DIR | 5 | 285.76465 | 5.92167 | 7 R HT | 14 | 318.47046 | 2.26709 |
| 24 SPD | 6 | 10.94118 | 2.48673 | 7 T LONG | 15 | 136.52940 | 19.69171 |
| SIZE | 7 | 3.64706 | 1.53871 | 7 T HT | 16 | 302.17627 | 2.81148 |
| 12 C SIZ | 8 | 0.05882 | 1.08804 | 12 C I | 17 | -2.35294 | 7.52447 |
| SLP | 9 | 996.29395 | 8.22925 | 24 C I | 18 | 2.94118 | 16.01355 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.964 | -0.099 | 0.336 | -0.060 | 0.441 | -0.801 | -0.264 | -0.225 | 0.268 | 0.479 | -0.394 | 0.534 | -0.954 | -0.843 | -0.221 | -0.669 | -0.048 |
| 2 | | 1.000 | 0.082 | -0.500 | -0.032 | -0.583 | 0.658 | 0.111 | 0.449 | -0.129 | -0.683 | 0.592 | -0.670 | 0.946 | 0.867 | 0.082 | 0.561 | -0.037 |
| 3 | | | 1.000 | -0.059 | 0.877 | -0.299 | 0.272 | 0.218 | -0.332 | -0.098 | 0.130 | -0.421 | -0.129 | -0.020 | 0.015 | 0.551 | 0.076 | 0.840 |
| 4 | | | | 1.000 | 0.150 | 0.902 | -0.182 | 0.258 | -0.569 | 0.163 | 0.849 | -0.658 | 0.771 | -0.217 | 0.576 | -0.183 | -0.028 | 0.333 |
| 5 | | | | | 1.000 | -0.031 | 0.374 | 0.371 | -0.535 | -0.055 | 0.381 | -0.657 | 0.208 | -0.089 | -0.102 | 0.671 | 0.008 | 0.828 |
| 6 | | | | | | 1.000 | -0.316 | 0.048 | -0.534 | 0.273 | 0.808 | -0.592 | 0.880 | -0.316 | -0.668 | -0.177 | -0.275 | 0.020 |
| 7 | | | | | | | 1.000 | 0.573 | -0.228 | -0.583 | -0.083 | -0.082 | -0.246 | 0.624 | 0.660 | 0.622 | 0.653 | 0.298 |
| 8 | | | | | | | | 1.000 | -0.288 | -0.293 | 0.298 | -0.342 | 0.103 | 0.140 | 0.337 | 0.344 | 0.438 | 0.563 |
| 9 | | | | | | | | | 1.000 | 0.447 | -0.882 | 0.936 | -0.588 | 0.337 | 0.449 | -0.648 | -0.114 | -0.391 |
| 10 | | | | | | | | | | 1.000 | -0.131 | 0.207 | 0.295 | -0.082 | -0.319 | -0.560 | -0.680 | -0.005 |
| 11 | | | | | | | | | | | 1.000 | -0.931 | 0.813 | -0.494 | -0.664 | 0.268 | -0.078 | 0.376 |
| 12 | | | | | | | | | | | | 1.000 | -0.710 | 0.493 | 0.577 | -0.540 | 0.093 | -0.560 |
| 13 | | | | | | | | | | | | | 1.000 | -0.491 | -0.762 | 0.041 | -0.496 | 0.155 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.757 | -0.033 | 0.619 | -0.032 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.126 | 0.646 | -0.052 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.198 | 0.356 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.100 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XVI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during March (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 3

Number of 6-Hourly Observations: 13

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 8.56922 | 1.40557 | 12 C SLP | 10 | 3.69231 | 3.70550 |
| LONG | 2 | 145.69223 | 17.71602 | MAX I | 11 | 45.00000 | 17.91182 |
| 12 DIR | 3 | 282.07690 | 9.04121 | MIN 7 HT | 12 | 305.69214 | 7.85689 |
| 12 SPD | 4 | 11.84615 | 2.82389 | 7 R LT | 13 | 22.23076 | 1.87767 |
| 24 DIR | 5 | 284.76904 | 6.49555 | 7 R HT | 14 | 318.00000 | 2.41523 |
| 24 SPD | 6 | 11.53846 | 2.56954 | 7 T LONG | 15 | 129.61537 | 17.23145 |
| SIZE | 7 | 2.92308 | 0.86232 | 7 T HT | 16 | 301.30762 | 2.65784 |
| 12 C SIZ | 8 | -0.23077 | 1.09193 | 12 C I | 17 | -4.61538 | 7.20576 |
| SLP | 9 | 997.00000 | 9.38083 | 24 C I | 18 | 0.76923 | 17.89392 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.960 | 0.076 | 0.196 | 0.165 | 0.243 | -0.717 | 0.044 | -0.404 | -0.226 | 0.498 | -0.525 | 0.454 | -0.977 | -0.745 | 0.186 | -0.505 | 0.132 |
| 2 | | 1.000 | -0.056 | -0.419 | -0.223 | -0.468 | 0.544 | -0.174 | 0.613 | 0.312 | -0.711 | 0.705 | -0.624 | 0.941 | 0.828 | -0.279 | 0.397 | -0.190 |
| 3 | | | 1.000 | 0.027 | 0.867 | -0.210 | 0.086 | 0.103 | -0.305 | 0.113 | 0.175 | -0.424 | -0.050 | -0.137 | -0.216 | 0.505 | -0.090 | 0.829 |
| 4 | | | | 1.000 | 0.275 | 0.897 | 0.200 | 0.501 | -0.661 | -0.069 | 0.857 | -0.708 | 0.746 | -0.110 | -0.517 | -0.004 | 0.187 | 0.448 |
| 5 | | | | | 1.000 | 0.128 | 0.220 | 0.262 | -0.517 | 0.222 | 0.451 | -0.678 | 0.340 | -0.239 | -0.425 | 0.632 | -0.212 | 0.815 |
| 6 | | | | | | 1.000 | 0.171 | 0.345 | -0.685 | -0.042 | 0.842 | -0.685 | 0.870 | -0.175 | -0.556 | 0.108 | -0.035 | 0.153 |
| 7 | | | | | | | 1.000 | 0.334 | -0.185 | 0.018 | 0.081 | -0.090 | 0.063 | 0.640 | 0.245 | 0.302 | 0.407 | 0.166 |
| 8 | | | | | | | | 1.000 | -0.244 | 0.063 | 0.426 | -0.368 | 0.313 | -0.063 | 0.021 | 0.084 | 0.224 | 0.522 |
| 9 | | | | | | | | | 1.000 | 0.465 | -0.925 | 0.942 | -0.681 | 0.438 | 0.740 | -0.689 | -0.031 | -0.367 |
| 10 | | | | | | | | | | 1.000 | -0.308 | 0.240 | 0.119 | 0.261 | 0.215 | -0.286 | -0.495 | 0.230 |
| 11 | | | | | | | | | | | 1.000 | -0.947 | 0.818 | -0.482 | -0.764 | 0.429 | -0.000 | -0.429 |
| 12 | | | | | | | | | | | | 1.000 | -0.763 | 0.553 | 0.800 | -0.630 | 0.142 | -0.567 |
| 13 | | | | | | | | | | | | | 1.000 | -0.423 | -0.775 | 0.285 | -0.407 | 0.255 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.723 | -0.338 | 0.527 | -0.145 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.401 | 0.448 | -0.295 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.181 | 0.266 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | -0.051 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XVII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during March (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 3

Number of 6-Hourly Observations: 46

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 9.25586 | 2.33435 | 12 C SLP | 10 | -6.85294 | 9.25769 |
| LONG | 2 | 136.58501 | 5.46002 | MAX I | 11 | 66.32352 | 22.74057 |
| 12 DIR | 3 | 287.47046 | 11.65470 | MIN 7 HT | 12 | 288.55859 | 18.87466 |
| 12 SPD | 4 | 9.70588 | 3.52934 | 7 R LT | 13 | 23.64705 | 1.49509 |
| 24 DIR | 5 | 286.58813 | 10.39556 | 7 R HT | 14 | 316.23511 | 1.84323 |
| 24 SPD | 6 | 10.00000 | 3.10425 | 7 T LONG | 15 | 117.26 69 | 9.45261 |
| SIZE | 7 | 4.02941 | 0.83431 | 7 T HT | 16 | 301.94116 | 3.03456 |
| 12 C SIZ | 8 | 0.05882 | 0.77620 | 12 C I | 17 | 8.82353 | 8.07716 |
| SLP | 9 | 975.64697 | 21.62891 | 24 C I | 18 | 16.17647 | 10.66421 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.321 | 0.516 | -0.177 | 0.617 | -0.034 | 0.338 | 0.137 | -0.407 | -0.262 | 0.619 | -0.442 | -0.187 | -0.695 | -0.003 | -0.211 | -0.006 | -0.087 |
| 2 | | 1.000 | -0.084 | 0.726 | -0.071 | 0.696 | 0.138 | 0.070 | 0.841 | 0.441 | -0.634 | 0.845 | -0.333 | 0.732 | 0.111 | -0.345 | -0.377 | -0.483 |
| 3 | | | 1.000 | 0.131 | 0.871 | 0.186 | 0.170 | -0.161 | -0.189 | 0.054 | 0.402 | -0.231 | 0.328 | -0-070 | -0.130 | -0.421 | -01277 | -0.268 |
| 4 | | | | 1.000 | 0.201 | 0.951 | 0.003 | -0.159 | 0.689 | 0.522 | -0.395 | 0.653 | 0.100 | 0.756 | 0.323 | -0.319 | -0.220 | -0.321 |
| 5 | | | | | 1.000 | 0.263 | 0.386 | 0.007 | -0.162 | 0.000 | 0.412 | -0.204 | 0.261 | -0.145 | -0.222 | -0.450 | -0.190 | -0.251 |
| 6 | | | | | | 1.000 | 0.000 | -0.126 | 0.644 | 0.485 | -0.328 | 0.608 | 0.026 | 0.667 | 0.378 | -0.344 | -0.284 | -0.398 |
| 7 | | | | | | | 1.000 | 0.559 | 0.007 | -0.338 | 0.054 | 0.016 | -0.040 | -0.162 | -0.216 | -0.358 | 0.005 | -0.072 |
| 8 | | | | | | | | 1.000 | 0.003 | -0.183 | -0.013 | 0.035 | -0.295 | -0.137 | -0.031 | -0.320 | -0.085 | -0.100 |
| 9 | | | | | | | | | 1.000 | 0.628 | -0.856 | 0.993 | -0.390 | 0.664 | 0.071 | -0.358 | -0.359 | -0.611 |
| 10 | | | | | | | | | | 1.000 | -0.356 | 0.616 | -0.265 | 0.488 | -0.024 | -0.283 | -0.259 | -0.451 |
| 11 | | | | | | | | | | | 1.000 | -0.859 | 0.322 | -0.564 | -0.004 | 0.078 | 0.429 | 0.546 |
| 12 | | | | | | | | | | | | 1.000 | -0.407 | 0.670 | 0.049 | -0.355 | -0.345 | -0.591 |
| 13 | | | | | | | | | | | | | 1.000 | 0.240 | 0.101 | 0.211 | 0.291 | 0.492 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.228 | -0.214 | -0.205 | -0.184 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.005 | 0.149 | 0.128 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.121 | 0.381 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.782 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XVIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during April (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 3

Number of 6-Hourly Observations: 23

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 11.95650 | 3.01629 | 12 C SLP | 10 | 6.95652 | 5.08543 |
| LONG | 2 | 127.69994 | 3.76702 | MAX I | 11 | 81.73912 | 33.93202 |
| 12 DIR | 3 | 305.43457 | 26.67961 | MIN 7 HT | 12 | 274.95630 | 19.43394 |
| 12 SPD | 4 | 7.00000 | 5.93142 | 7 R LT | 13 | 314.47803 | 0.99405 |
| 24 DIR | 5 | 299.73901 | 20.21524 | 7 R HT | 14 | 101.86955 | 44.33580 |
| 24 SPD | 6 | 6.43478 | 4.83195 | 7 T LONG | 15 | 286.86938 | 84.17355 |
| SIZE | 7 | 3.60870 | 0.89133 | 7 T HT | 16 | -8.91304 | 13.64788 |
| 12 C SIZ | 8 | -0.21739 | 0.67126 | 12 C I | 17 | -9.78261 | 21.92331 |
| SLP | 9 | 961.95630 | 23.46072 | 24 C I | 18 | -9.78261 | 21.92331 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.272 | -0.337 | 0.397 | -0.257 | 0.441 | 0.785 | -0.151 | -0.508 | -0.005 | 0.633 | -0.506 | 0.662 | 0.145 | -0.215 | -0.199 | 0.379 | 0.325 |
| 2 | | 1.000 | -0.353 | 0.656 | -0.343 | 0.561 | -0.164 | -0.289 | 0.306 | -0.604 | -0.287 | 0.323 | -0.491 | 0.540 | -0.200 | -0.121 | -0.142 | 0.275 |
| 3 | | | 1.000 | -0.677 | 0.796 | -0.700 | -0.335 | 0.224 | 0.484 | 0.475 | -0.577 | 0.455 | -0.306 | -0.353 | 0.211 | 0.141 | -0.282 | -0.520 |
| 4 | | | | 1.000 | -0.563 | 0.979 | 0.206 | -0.400 | 0.007 | -0.449 | 0.163 | 0.043 | -0.047 | 0.802 | -0.195 | -0.086 | -0.003 | 0.400 |
| 5 | | | | | 1.000 | -0.598 | -0.235 | 0.237 | 0.409 | 0.383 | -0.482 | 0.385 | -0.005 | -0.292 | 0.199 | 0.125 | -0.185 | -0.422 |
| 6 | | | | | | 1.000 | 0.189 | -0.446 | -0.037 | -0.362 | 0.210 | 0.003 | -0.005 | 0.769 | -0.157 | -0.041 | -0.073 | 0.349 |
| 7 | | | | | | | 1.000 | 0.231 | -0.736 | -0.275 | 0.767 | -0.746 | 0.659 | -0.138 | -0.357 | -0.368 | 0.653 | 0.540 |
| 8 | | | | | | | | 1.000 | -0.116 | 0.184 | 0.067 | -0.123 | -0.015 | -0.246 | 0.298 | 0.256 | 0.275 | -0.120 |
| 9 | | | | | | | | | 1.000 | 0.376 | -0.971 | 0.998 | -0.750 | 0.477 | 0.301 | 0.320 | -0.718 | -0.710 |
| 10 | | | | | | | | | | 1.000 | -0.353 | 0.361 | -0.083 | -0.113 | 0.405 | 0.386 | -0.507 | -0.815 |
| 11 | | | | | | | | | | | 1.000 | -0.960 | 0.757 | -0.295 | -0.272 | -0.271 | 0.722 | 0.720 |
| 12 | | | | | | | | | | | | 1.000 | -0.755 | 0.505 | 0.322 | 0.347 | -0.717 | -0.693 |
| 13 | | | | | | | | | | | | | 1.000 | -0.399 | -0.213 | -0.256 | 0.550 | 0.468 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.018 | 0.106 | -0.308 | -0.109 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.989 | -0.108 | -0.427 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.155 | -0.409 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.713 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XIX. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during April (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 51

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 12.34781 | 3.24469 | 12 C SLP | 10 | -4.95652 | 7.07413 |
| LONG | 2 | 128.49553 | 2.96548 | MAX I | 11 | 80.00000 | 26.01047 |
| 12 DIR | 3 | 293.65210 | 17.80092 | MIN 7 HT | 12 | 290.69556 | 14.72297 |
| 12 SPD | 4 | 8.47826 | 2.95219 | 7 R LT | 13 | 20.08694 | 2.62701 |
| 24 DIR | 5 | 292.86938 | 15.66785 | 7 R HT | 14 | 315.69556 | 0.76484 |
| 24 SPD | 6 | 8.34783 | 2.53357 | 7 T LONG | 15 | 115.47826 | 8.17351 |
| SIZE | 7 | 3.47826 | 0.59311 | 7 T HT | 16 | 115.47826 | 8.17351 |
| 12 C SIZ | 8 | -0.08696 | 0.66831 | 12 C I | 17 | 307.86938 | 2.41782 |
| SLP | 9 | 978.52173 | 16.51407 | 24 C I | 18 | 16.73912 | 22.56548 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.820 | 0.790 | 0.755 | 0.801 | 0.795 | -0.053 | -0.394 | -0.914 | -0.345 | 0.868 | -0.915 | 0.822 | 0.312 | -0.249 | -0.380 | 0.207 | 0.286 |
| 2 | | 1.000 | -0.666 | -0.391 | -0.533 | -0.407 | -0.012 | 0.209 | 0.875 | 0.483 | -0.793 | 0.924 | -0.894 | -0.207 | 0.177 | 0.056 | -0.307 | -0.227 |
| 3 | | | 1.000 | 0.543 | 0.920 | 0.612 | 0.171 | -0.136 | -0.898 | -0.461 | 0.919 | -0.852 | 0.659 | 0.152 | -0.187 | -0.353 | 0.467 | 0.690 |
| 4 | | | | 1.000 | 0.656 | 0.870 | 0.175 | -0.554 | -0.558 | -0.188 | 0.504 | -0.515 | 0.493 | 0.269 | 0.001 | -0.564 | 0.035 | 0.113 |
| 5 | | | | | 1.000 | 0.677 | 0.115 | -0.348 | -0.812 | -0.226 | 0.851 | -0.758 | 0.570 | 0-201 | -0.267 | -0.382 | 0.288 | 0.545 |
| 6 | | | | | | 1.000 | -0.055 | -0.465 | -0.634 | -0.287 | 0.633 | -0.593 | 0.535 | 0.409 | -0.017 | -0.593 | 0.199 | 0.270 |
| 7 | | | | | | | 1.000 | -0.005 | 0.038 | -0.124 | -0.053 | 0.080 | 0.118 | -0.065 | 0.616 | -0.303 | 0.258 | 0.146 |
| 8 | | | | | | | | 1.000 | 0.214 | -0.124 | -0.233 | 0.224 | -0.280 | -0.232 | -0.167 | 0.415 | 0.066 | 0.047 |
| 9 | | | | | | | | | 1.000 | 0.582 | -0.970 | 0.987 | -0.836 | -0.314 | 0.309 | 0.272 | -0.454 | -0.541 |
| 10 | | | | | | | | | | 1.000 | -0.522 | 0.539 | -0.509 | -0.417 | -0.042 | 0.293 | -0.754 | -0.597 |
| 11 | | | | | | | | | | | 1.000 | -0.942 | 0.790 | 0.366 | -0.321 | -0.276 | 0.542 | 0.656 |
| 12 | | | | | | | | | | | | 1.000 | -0.844 | -0.255 | 0.299 | 0.208 | -0.377 | -0.451 |
| 13 | | | | | | | | | | | | | 1.000 | 0.511 | -0.051 | -0.299 | 0.495 | 0.257 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.034 | -0.391 | 0.601 | 0.230 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.500 | 0.135 | -0.067 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.332 | -0.326 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.775 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XX. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during May (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 25

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 14.61428 | 4.41062 | 12 C SLP | 10 | 1.71428 | 3.04905 |
| LONG | 2 | 127.50708 | 4.88554 | MAX I | 11 | 54.28571 | 46.41853 |
| 12 DIR | 3 | 309.28564 | 40.96983 | MIN 7 HT | 12 | 297.00000 | 20.07294 |
| 12 SPD | 4 | 7.07143 | 3.89209 | 7 R LT | 13 | 24.92856 | 5.62226 |
| 24 DIR | 5 | 311.78564 | 23.95244 | 7 R HT | 14 | 316.12411 | 0.89258 |
| 24 SPD | 6 | 7.07143 | 3.47440 | 7 T LONG | 15 | 305.71411 | 9.25018 |
| SIZE | 7 | 2.78571 | 0.57893 | 7 T HT | 16 | -3.21428 | 3.83162 |
| 12 C SIZ | 8 | -0.42857 | 0.75593 | 12 C I | 17 | 0.71429 | 7.74773 |
| SLP | 9 | 987.78564 | 23.59651 | 24 C I | 18 | 0.71429 | 14.99450 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.653 | 0.376 | 0.250 | 0.460 | 0.402 | 0.176 | 0.207 | -0.880 | 0.862 | 0.834 | -0.889 | 0.963 | 0.579 | -0.573 | 0.497 | -0.608 | -0.317 |
| 2 | | 1.000 | -0.436 | -0.856 | -0.393 | -0.908 | -0.095 | -0.416 | 0.809 | -0.404 | -0.705 | 0.846 | -0.547 | -0.089 | -0.080 | -0.554 | 0.135 | -0.065 |
| 3 | | | 1.000 | 0.278 | -0.328 | 0.287 | -0.497 | -0.068 | -0.351 | 0.200 | 0.280 | -0.381 | 0.314 | -0.149 | 0.064 | 0.290 | -0.231 | -0.333 |
| 4 | | | | 1.000 | 0.357 | 0.967 | 0.007 | 0.456 | -0.455 | -0.031 | 0.325 | -0.502 | 0.123 | -0.293 | 0.482 | 0.228 | 0.184 | 0.201 |
| 5 | | | | | 1.000 | 0.395 | 0.684 | 0.611 | -0.416 | 0.526 | 0.380 | -0.434 | 0.421 | 0.423 | -0.195 | 0.180 | -0.322 | -0.024 |
| 6 | | | | | | 1.000 | 0.085 | 0.452 | -0.577 | 0.104 | 0.449 | -0.623 | 0.296 | -0.154 | 0.344 | 0.256 | 0.081 | 0.154 |
| 7 | | | | | | | 1.000 | 0.653 | -0.280 | 0.311 | 0.323 | -0.271 | 0.255 | 0.691 | -0.364 | 0.317 | -0.080 | 0.241 |
| 8 | | | | | | | | 1.000 | -0.299 | 0.176 | 0.210 | -0.345 | 0.264 | 0.375 | 0.080 | 0.247 | -0.122 | -0.039 |
| 9 | | | | | | | | | 1.000 | -0.652 | -0.980 | 0.996 | -0.854 | -0.545 | 0.510 | -0.744 | 0.232 | -0.118 |
| 10 | | | | | | | | | | 1.000 | 0.644 | -0.660 | 0.815 | 0.646 | -0.598 | 0.486 | -0.823 | -0.470 |
| 11 | | | | | | | | | | | 1.000 | -0.959 | 0.825 | 0.598 | -0.627 | 0.799 | -0.175 | 0.222 |
| 12 | | | | | | | | | | | | 1.000 | -0.857 | -0.524 | 0.452 | -0.718 | 0.265 | -0.066 |
| 13 | | | | | | | | | | | | | 1.000 | 0.693 | -0.674 | 0.481 | -0.580 | -0.280 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.779 | 0.469 | -0.393 | -0.070 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.463 | 0.301 | -0.035 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.083 | 0.304 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.852 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during May (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 6

Number of 6-Hourly Observations: 60

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 15.09995 | 2.09938 | 12 C SLP | 10 | -6.42857 | 5.72176 |
| LONG | 2 | 128.23772 | 4.95140 | MAX I | 11 | 88.73808 | 29.98050 |
| 12 DIR | 3 | 289.00000 | 13.07201 | MIN 7 HT | 12 | 285.92847 | 16.01733 |
| 12 SPD | 4 | 10.61905 | 2.09474 | 7 R LT | 13 | 23.95238 | 2.34731 |
| 24 DIR | 5 | 288.09521 | 11.76146 | 7 R HT | 14 | 314.57129 | 2.07356 |
| 24 SPD | 6 | 10.83333 | 2.32606 | 7 T LONG | 15 | 117.88095 | 9.32659 |
| SIZE | 7 | 3.83333 | 0.79377 | 7 T HT | 16 | 305.38086 | 3.25315 |
| 12 C SIZ | 8 | 0.04762 | 0.85404 | 12 C I | 17 | 12.61905 | 10.21703 |
| SLP | 9 | 972.16650 | 17.09642 | 24 C I | 18 | 24.69048 | 16.14334 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.769 | 0.634 | 0.255 | 0.644 | 0.288 | 0.284 | -0.067 | -0.260 | 0.200 | 0.106 | -0.311 | 0.441 | -0.392 | -0.450 | -0.019 | -0.348 | -0.490 |
| 2 | | 1.000 | -0.378 | -0.472 | -0.366 | -0.387 | -0.240 | 0.160 | 0.420 | -0.156 | -0.150 | 0.432 | -0.818 | 0.179 | 0.658 | -0.150 | 0.054 | 0.176 |
| 3 | | | 1.000 | 0.200 | 0.659 | 0.304 | 0.066 | -0.044 | -0.018 | 0.178 | -0.075 | -0.084 | 0.103 | 0.130 | -0.108 | -0.022 | -0.194 | -0.237 |
| 4 | | | | 1.000 | 0.008 | 0.753 | 0.225 | -0.017 | -0.199 | -0.213 | 0.040 | -0.192 | 0.458 | 0.231 | -0.351 | 0.161 | 0.008 | -0.002 |
| 5 | | | | | 1.000 | -0.145 | 0.080 | -0.015 | -0.089 | 0.072 | -0.046 | -0.139 | 0.159 | -0.098 | -0.113 | -0.069 | -0.179 | -0.291 |
| 6 | | | | | | 1.000 | 0.183 | -0.033 | -0.013 | -0.093 | -0.127 | -0.021 | 0.347 | 0.344 | -0.246 | 0.063 | -0.045 | -0.034 |
| 7 | | | | | | | 1.000 | 0.552 | 0.444 | 0.172 | -0.459 | 0.425 | 0.271 | -0.252 | -0.253 | 0.242 | -0.477 | -0.430 |
| 8 | | | | | | | | 1.000 | 0.255 | 0.189 | -0.201 | 0.268 | -0.072 | 0.012 | 0.276 | -0.059 | -0.241 | -0.094 |
| 9 | | | | | | | | | 1.000 | 0.270 | -0.890 | 0.992 | -0.128 | 0.219 | 0.078 | 0.338 | -0.301 | -0.159 |
| 10 | | | | | | | | | | 1.000 | -0.092 | 0.274 | 0.225 | -0.098 | -0.176 | 0.033 | -0.234 | 0.020 |
| 11 | | | | | | | | | | | 1.000 | -0.880 | -0.131 | -0.292 | 0.035 | -0.359 | 0.231 | 0.203 |
| 12 | | | | | | | | | | | | 1.000 | -0.101 | 0.254 | 0.092 | 0.339 | -0.255 | -0.105 |
| 13 | | | | | | | | | | | | | 1.000 | 0.131 | -0.683 | 0.402 | 0.108 | 0.131 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.065 | 0.220 | 0.503 | 0.625 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0-591 | 0.050 | 0.124 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.159 | 0.058 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.832 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during June (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 6

Number of 6-Hourly Observations: 7

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 18.57690 | 3.26806 | 12 C SLP | 10 | 6.62538 | 8.22130 |
| LONG | 2 | 124.03838 | 7.72434 | MAX I | 11 | 93.23076 | 41.98044 |
| 12 DIR | 3 | 312.76904 | 18.42169 | MIN 7 HT | 12 | 284.76904 | 19.17094 |
| 12 SPD | 4 | 10.46154 | 1.71344 | 7 R LT | 13 | 26.07692 | 1.49786 |
| 24 DIR | 5 | 308.00000 | 15.55099 | 7 R HT | 14 | 312.92285 | 2.81252 |
| 24 SPD | 6 | 9.84615 | 1.40512 | 7 T LONG | 15 | 116.07692 | 11.43431 |
| SIZE | 7 | 2.53846 | 0.87706 | 7 T HT | 16 | 306.69214 | 2.49615 |
| 12 C SIZ | 8 | -0.61538 | 0.76795 | 12 C I | 17 | -9.84615 | 11.73915 |
| SLP | 9 | 970.61523 | 19.58116 | 24 C I | 18 | 1.69231 | 21.08862 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.723 | 0.530 | 0.039 | 0.620 | 0.384 | -0.158 | -0.239 | -0.299 | 0.468 | 0.374 | -0.360 | 0.334 | -0.942 | -0.692 | -0.036 | -0.100 | -0.575 |
| 2 | | 1.000 | -0.286 | 0.445 | -0.376 | -0.052 | -0.431 | 0.187 | 0.484 | -0.138 | -0.460 | 0.562 | -0.498 | 0.563 | 0.921 | -0.394 | -0.313 | 0.052 |
| 3 | | | 1.000 | -0.039 | 0.980 | -0.008 | -0.131 | 0.136 | -0.255 | 0.662 | 0.431 | -0.372 | -0.365 | -0.576 | 0.245 | 0.446 | -0.271 | -0.613 |
| 4 | | | | 1.000 | -0.069 | 0.793 | -0.845 | -0.019 | 0.125 | 0.552 | -0.020 | 0.171 | -0.177 | -0.061 | 0.381 | -0.432 | -0.762 | -0.538 |
| 5 | | | | | 1.000 | -0.004 | -0.104 | 0.084 | -0.183 | 0.660 | 0.365 | -0.303 | -0.200 | -0.636 | -0.365 | 0.425 | -0.256 | -0.651 |
| 6 | | | | | | 1.000 | -0.671 | 0.059 | -0.196 | 0.665 | 0.302 | -0.150 | 0.125 | -0.320 | -0.082 | -0.276 | -0.595 | -0.477 |
| 7 | | | | | | | 1.000 | 0.162 | -0.060 | -0.547 | -0.058 | -0.106 | 0.283 | 0.255 | -0.428 | 0.539 | 0.736 | 0.541 |
| 8 | | | | | | | | 1.000 | -0.100 | 0.289 | 0.196 | -0.050 | -0.318 | 0.169 | 0.139 | 0.328 | -0.035 | -0.008 |
| 9 | | | | | | | | | 1.000 | -0.225 | -0.958 | 0.981 | 0.353 | 0.328 | 0.231 | -0.194 | -0.264 | -0.240 |
| 10 | | | | | | | | | | 1.000 | 0.461 | -0.264 | -0.180 | -0.427 | -0.177 | 0.229 | -0.654 | -0.735 |
| 11 | | | | | | | | | | | 1.000 | -0.945 | -0.386 | -0.381 | -0.263 | 0.256 | 0.137 | 0.060 |
| 12 | | | | | | | | | | | | 1.000 | 0.337 | 0.378 | 0.306 | -0.315 | -0.213 | -0.154 |
| 13 | | | | | | | | | | | | | 1.000 | -0.117 | -0.623 | -0.082 | 0.151 | -0.012 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.467 | 0.151 | 0.157 | 0.574 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.440 | -0.268 | 0.144 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.042 | 0.001 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.744 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during June (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 21

Number of 6-Hourly Observations: 251

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 17.26657 | 4.13427 | 12 C SLP | 10 | -6.62144 | 9.06753 |
| LONG | 2 | 135.70229 | 7.64074 | MAX I | 11 | 78.65248 | 27.75966 |
| 12 DIR | 3 | 297.65942 | 27.61720 | MIN 7 HT | 12 | 288.11328 | 21.57544 |
| 12 SPD | 4 | 11.57447 | 4.17514 | 7 R LT | 13 | 28.64539 | 3.60976 |
| 24 DIR | 5 | 295.27637 | 37.79814 | 7 R HT | 14 | 316.63818 | 2.70785 |
| 24 SPD | 6 | 11.11347 | 4.01797 | 7 T LONG | 15 | I15.45389 | 10.22421 |
| SIZE | 7 | 4.65248 | 1.86694 | 7 T HT | 16 | 307.07788 | -3.51947 |
| 12 C SIZ | 8 | 0.02128 | 1.13684 | 12 C I | 17 | 12.31206 | 11.55423 |
| SLP | 9 | 974.59570 | 24.72037 | 24 C I | 18 | 23.47517 | 17.21812 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.222 | 0.190 | -0.112 | 0.266 | -0.048 | -0.234 | -0.141 | -0.241 | -0.225 | 0.067 | -0.283 | 0.766 | -0.174 | 0.170 | 0.102 | 0.083 | 0.050 |
| 2 | | 1.000 | 0.321 | -0.239 | 0.237 | -0.376 | -0.010 | 0.186 | 0.079 | 0.060 | -0.242 | 0.053 | 0.440 | 0.315 | 0.320 | 0.067 | -0.096 | -0.076 |
| 3 | | | 1.000 | -0.199 | 0.602 | -0.319 | 0.220 | 0.251 | -0.092 | -0.142 | -0.118 | -0.125 | 0.280 | 0.085 | 0.091 | -0.026 | 0.020 | -0.002 |
| 4 | | | | 1.000 | -0.022 | 0.913 | 0.105 | 0.006 | 0.388 | 0.207 | -0.199 | 0.396 | -0.188 | 0.131 | -0.179 | 0.092 | -0.087 | -0.035 |
| 5 | | | | | 1.000 | -0.087 | 0.093 | 0.135 | -0.093 | -0.145 | -0.030 | -0.110 | 0.356 | 0.101 | 0.023 | 0.053 | 0.129 | 0.098 |
| 6 | | | | | | 1.000 | 0.036 | -0.019 | 0.275 | 0.150 | -0.067 | 0.297 | -0.172 | 0.069 | -0.223 | 0.148 | -0.090 | -0.019 |
| 7 | | | | | | | 1.000 | 0.323 | -0.236 | -0.151 | 0.009 | -0.239 | -0.177 | -0.127 | -0.032 | 0.027 | -0.077 | -0.053 |
| 8 | | | | | | | | 1.000 | 0.034 | -0.108 | -0.160 | 0.011 | -0.014 | 0.081 | -0.124 | -0.074 | -0.063 | -0.000 |
| 9 | | | | | | | | | 1.000 | 0.602 | -0.747 | 0.988 | -0.214 | 0.127 | 0.097 | -0.247 | -0.397 | -0.474 |
| 10 | | | | | | | | | | 1.000 | -0.275 | 0.605 | -0.235 | 0.018 | 0.110 | -0.224 | -0.579 | -0.470 |
| 11 | | | | | | | | | | | 1.000 | -0.717 | 0.064 | -0.056 | -0.049 | 0.204 | 0.465 | 0.571 |
| 12 | | | | | | | | | | | | 1.000 | -0.250 | 0.141 | 0.112 | -0.216 | -0.400 | -0.470 |
| 13 | | | | | | | | | | | | | 1.000 | 0.216 | 0.069 | 0.360 | 0.189 | 0.213 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.086 | 0.334 | -0.035 | 0.055 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.244 | -0.063 | -0.140 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.124 | 0.163 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.794 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXIV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during July (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 21

Number of 6-Hourly Observations: 213

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 23.28114 | 7.00525 | 12 C SLP | 10 | 2.38830 | 8.02083 |
| LONG | 2 | 130.81773 | 7.47216 | MAX I | 11 | 68.39362 | 35.91660 |
| 12 DIR | 3 | 302.24463 | 32.31979 | MIN 7 HT | 12 | 287.53711 | 23.30916 |
| 12 SPD | 4 | 10.90425 | 3.27056 | 7 R LT | 13 | 33.03723 | 5.48143 |
| 24 DIR | 5 | 303.31372 | 22.65956 | 7 R HT | 14 | 315.53174 | 2.92399 |
| 24 SPD | 6 | 10.83511 | 3.08166 | 7 T LONG | 15 | 114.55318 | 9.63124 |
| SIZE | 7 | 4.15957 | 1.88322 | 7 T HT | 16 | 308.13818 | 3.45512 |
| 12 C SIZ | 8 | -0.18617 | 1.06093 | 12 C I | 17 | -6.61170 | 10.52382 |
| SLP | 9 | 974.82446 | 27.07266 | 24 C I | 18 | -6.91489 | 19.98869 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.078 | 0.239 | -0.097 | 0.414 | -0.100 | -0.360 | -0.126 | -0.085 | 0.191 | -0.042 | -0.031 | 0.863 | -0.359 | 0.078 | -0.314 | -0.090 | -0.206 |
| 2 | | 1.000 | -0.148 | 0.032 | -0.123 | 0.010 | 0.333 | 0.261 | -0.005 | -0.270 | -0.046 | 0.014 | 0.161 | 0.464 | 0.306 | 0.240 | 0.211 | 0.168 |
| 3 | | | 1.000 | -0.126 | 0.582 | -0.198 | -0.183 | -0.007 | 0.025 | 0.200 | -0.048 | 0.014 | 0.104 | -0.241 | -0.074 | -0.006 | -0.118 | -0.151 |
| 4 | | | | 1.000 | -0.170 | 0.928 | 0.216 | 0.058 | -0.047 | 0.072 | 0.165 | -0.053 | -0.002 | 0.434 | -0.109 | 0.126 | -0.026 | -0.018 |
| 5 | | | | | 1.000 | -0.278 | -0.145 | 0.042 | 0.006 | 0.225 | -0.127 | 0.010 | 0.283 | -0.470 | 0.078 | -0.074 | -0.159 | -0.228 |
| 6 | | | | | | 1.000 | 0.211 | 0.015 | 0.014 | 0.096 | 0.121 | 0.013 | -0.009 | 0.445 | -0.179 | 0.158 | -0.059 | -0.070 |
| 7 | | | | | | | 1.000 | 0.307 | -0.250 | 0.024 | 0.085 | -0.279 | -0.079 | 0.167 | 0.008 | 0.167 | 0.281 | 0.213 |
| 8 | | | | | | | | 1.000 | -0.042 | 0.051 | 0.044 | -0.037 | -0.026 | 0.098 | 0.266 | 0.243 | -0.037 | -0.001 |
| 9 | | | | | | | | | 1.000 | 0.030 | -0.856 | 0.990 | -0.118 | 0.001 | -0.006 | -0.010 | -0.200 | -0.283 |
| 10 | | | | | | | | | | 1.000 | 0.032 | 0.017 | 0.163 | -0.164 | -0.070 | 0.061 | -0.483 | -0.461 |
| 11 | | | | | | | | | | | 1.000 | -0.839 | -0.086 | 0.065 | -0.014 | -0.030 | 0.151 | 0.326 |
| 12 | | | | | | | | | | | | 1.000 | -0.090 | -0.015 | -0.003 | -0.036 | -0.219 | -0.304 |
| 13 | | | | | | | | | | | | | 1.000 | -0.177 | 0.211 | -0.152 | -0.021 | -0.162 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.029 | 0.467 | 0.042 | 0.032 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.088 | -0.050 | 0.001 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.132 | -0.103 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.780 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during July (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 26

Number of 6-Hourly Observations: 322

| Variable | | Mean | Standard Deviation | Variable | Mean | Standard Deviation |
|---|---|---|---|---|---|---|
| LAT | 1 | 19.59116 | 6.16035 | 12 C SLP | -6.93443 | 7.53344 |
| LONG | 2 | 133.59541 | 9.03248 | MAX I | 75.40984 | 28.44270 |
| 12 DIR | 3 | 303.28955 | 26.72043 | MIN 7 HT | 290.53540 | 16.28409 |
| 12 SPD | 4 | 11.97814 | 4.56690 | 7 R LT | 316.86328 | 3.01787 |
| 24 DIR | 5 | 302.37158 | 25.90388 | 7 R HT | 116.83060 | 8.55349 |
| 24 SPD | 6 | 11.56831 | 4.26130 | 7 T LONG | 309.15845 | 3.37930 |
| SIZE | 7 | 3.99454 | 1.62566 | 7 T HT | 309.15845 | 3.37930 |
| 12 C SIZ | 8 | -0.07650 | 0.92857 | 12 C I | 11.17486 | 9.40077 |
| SLP | 9 | 976.27319 | 18.88542 | 24 C I | 20.85245 | 15.30867 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.021 | 0.498 | -0.036 | 0.501 | -0.059 | -0.356 | -0.022 | -0.249 | 0.013 | 0.215 | -0.213 | 0.605 | -0.225 | -0.007 | 0.110 | -0.015 | -0.022 |
| 2 | | 1.000 | 0.224 | 0.374 | 0.271 | 0.285 | -0.253 | -0.117 | 0.359 | 0.242 | -0.032 | 0.366 | 0.262 | 0.576 | 0.417 | -0.059 | 0.007 | 0.020 |
| 3 | | | 1.000 | -0.010 | 0.901 | -0.084 | -0.430 | -0.075 | -0.090 | 0.060 | 0.104 | -0.042 | 0.445 | 0.095 | 0.287 | -0.128 | -0.078 | -0.115 |
| 4 | | | | 1.000 | 0.151 | 0.952 | 0.029 | -0.009 | 0.020 | -0.121 | 0.258 | 0.026 | -0.047 | 0.482 | 0.038 | 0.122 | 0.138 | 0.230 |
| 5 | | | | | 1.000 | 0.055 | -0.458 | -0.076 | -0.090 | 0.040 | 0.162 | -0.040 | 0.446 | 0.194 | 0.340 | -0.081 | -0.052 | -0.061 |
| 6 | | | | | | 1.000 | 0.088 | 0.029 | -0.052 | -0.153 | 0.296 | -0.050 | -0.126 | 0.457 | -0.013 | 0.109 | 0.119 | 0.207 |
| 7 | | | | | | | 1.000 | 0.462 | -0.030 | -0.095 | -0.028 | -0.109 | -0.356 | 0.128 | -0.134 | 0.080 | 0.103 | 0.116 |
| 8 | | | | | | | | 1.000 | 0.037 | 0.057 | 0.048 | -0.012 | -0.062 | 0.065 | -0.112 | 0.023 | 0.093 | 0.062 |
| 9 | | | | | | | | | 1.000 | 0.645 | -0.750 | 0.976 | 0.056 | -0.058 | 0.213 | -0.027 | -0.353 | -0.397 |
| 10 | | | | | | | | | | 1.000 | -0.469 | 0.594 | 0.163 | -0.184 | 0.328 | -0.154 | -0.460 | -0.486 |
| 11 | | | | | | | | | | | 1.000 | -0.749 | 0.015 | 0.281 | -0.032 | 0.273 | 0.486 | 0.581 |
| 12 | | | | | | | | | | | | 1.000 | 0.111 | -0.079 | 0.224 | -0.090 | -0.353 | -0.386 |
| 13 | | | | | | | | | | | | | 1.000 | -0.021 | 0.090 | -0.160 | -0.019 | -0.034 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.193 | -0.022 | 0.261 | 0.289 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.006 | -0.116 | -0.130 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.089 | 0.152 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.857 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXVI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during August (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 26

Number of 6-Hourly Observations: 132

| Variable | | Mean | Standard Deviation |
|---|---|---|---|
| LAT | 1 | 24.97118 | 5.37737 |
| LONG | 2 | 130.87978 | 10.49715 |
| 12 DIR | 3 | 305.68066 | 30.49129 |
| 12 SPD | 4 | 11.78723 | 4.62082 |
| 24 DIR | 5 | 304.57446 | 27.40117 |
| 24 SPD | 6 | 11.62766 | 4.18902 |
| SIZE | 7 | 3.84043 | 1.99084 |
| 12 C SIZ | 8 | -0.09574 | 1.12708 |
| SLP | 9 | 971.72339 | 23.03542 |
| 12 C SLP | 10 | 3.67021 | 9.72233 |
| MAX I | 11 | 80.04254 | 39.12135 |
| MIN 7 HT | 12 | 285.11694 | 20.20421 |
| 7 R LT | 13 | 34.68085 | 3.15277 |
| 7 R HT | 14 | 114.78723 | 2.29331 |
| 7 T LONG | 15 | 310.17017 | 8.36381 |
| 7 T HT | 16 | -8.42553 | 3.21165 |
| 12 C I | 17 | -4.95745 | 14.81167 |
| 24 C I | 18 | -4.95745 | 24.25439 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.375 | 0.411 | 0.194 | 0.508 | 0.176 | -0.205 | 0.146 | -0.058 | 0.099 | 0.176 | -0.049 | 0.739 | -0.065 | 0.499 | -0.205 | -0.101 | -0.069 |
| 2 | | 1.000 | 0.091 | 0.175 | 0.132 | 0.133 | -0.365 | -0.006 | 0.169 | -0.225 | 0.006 | 0.172 | 0.387 | 0.445 | 0.639 | -0.171 | 0.048 | 0.126 |
| 3 | | | 1.000 | -0.257 | 0.905 | -0.368 | -0.392 | -0.004 | 0.127 | 0.063 | -0.060 | 0.156 | 0.102 | -0.247 | 0.145 | -0.475 | -0.014 | 0.005 |
| 4 | | | | 1.000 | -0.089 | 0.910 | 0.165 | 0.186 | -0.086 | -0.206 | 0.048 | -0.092 | 0.330 | 0.448 | 0.116 | 0.071 | 0.097 | 0.215 |
| 5 | | | | | 1.000 | -0.217 | -0.385 | -0.014 | 0.119 | 0.021 | -0.080 | 0.148 | 0.142 | -0.185 | 0.250 | -0.493 | -0.035 | 0.031 |
| 6 | | | | | | 1.000 | 0.204 | 0.170 | -0.140 | -0.161 | 0.101 | -0.137 | 0.308 | 0.465 | 0.062 | 0.203 | 0.055 | 0.154 |
| 7 | | | | | | | 1.000 | 0.329 | -0.359 | -0.053 | 0.296 | -0.416 | 0.006 | 0.161 | -0.253 | 0.465 | 0.182 | 0.031 |
| 8 | | | | | | | | 1.000 | -0.139 | 0.126 | 0.104 | -0.157 | 0.043 | 0.062 | -0.027 | 0.132 | -0.060 | -0.050 |
| 9 | | | | | | | | | 1.000 | 0.126 | -0.932 | 0.985 | -0.059 | -0.100 | 0.069 | -0.350 | -0.216 | -0.320 |
| 10 | | | | | | | | | | 1.000 | -0.153 | 0.103 | 0.016 | -0.332 | -0.111 | -0.209 | -0.587 | -0.586 |
| 11 | | | | | | | | | | | 1.000 | -0.908 | 0.176 | 0.124 | 0.076 | 0.287 | 0.305 | 0.379 |
| 12 | | | | | | | | | | | | 1.000 | -0.070 | -0.093 | 0.065 | -0.381 | -0.199 | -0.299 |
| 13 | | | | | | | | | | | | | 1.000 | 0.210 | 0.253 | -0.135 | -0.026 | -0.046 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.125 | 0.216 | 0.126 | 0.193 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.032 | 0.044 | 0.181 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.152 | 0.125 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.799 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXVII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during August (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 26

Number of 6-Hourly Observations: 276

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 18.75757 | 4.06586 | 12 C SLP | 10 | -7.11163 | 9.20507 |
| LONG | 2 | 135.66890 | 9.48343 | MAX I | 11 | 82.05580 | 37.28235 |
| 12 DIR | 3 | 293.00464 | 23.13550 | MIN 7 HT | 12 | 279.37671 | 25.81146 |
| 12 SPD | 4 | 11.29767 | 4.60844 | 7 R LT | 13 | 30.47441 | 3.78486 |
| 24 DIR | 5 | 293.33008 | 21.78000 | 7 R HT | 14 | 316.82324 | 1.98271 |
| 24 SPD | 6 | 10.87442 | 4.30257 | 7 T LONG | 15 | 119.40930 | 11.24362 |
| SIZE | 7 | 5.11628 | 1.90924 | 7 T HT | 16 | 311.00928 | 3.18874 |
| 12 C SIZ | 8 | 0.17674 | 1.10496 | 12 C I | 17 | 11.58605 | 9.27660 |
| SLP | 9 | 966.18115 | 29.85680 | 24 C I | 18 | 22.70697 | 15.97196 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.103 | -0.079 | 0.249 | 0.027 | 0.228 | -0.008 | -0.015 | -0.270 | 0.058 | 0.259 | -0.258 | 0.556 | -0.113 | 0.062 | 0.130 | -0.071 | -0.046 |
| 2 | | 1.000 | 0.009 | 0.173 | -0.002 | 0.112 | -0.304 | 0.125 | 0.149 | -0.108 | -0.299 | 0.148 | -0.119 | 0.406 | 0.473 | 0.126 | 0.053 | 0.060 |
| 3 | | | 1.000 | -0.304 | 0.927 | -0.368 | 0.055 | -0.004 | 0.004 | -0.085 | -0.056 | -0.019 | 0.144 | -0.088 | 0.125 | -0.208 | 0.073 | 0.074 |
| 4 | | | | 1.000 | -0.243 | 0.956 | -0.256 | -0.098 | -0.165 | -0.190 | 0.200 | -0.098 | 0.091 | 0.215 | -0.167 | 0.151 | 0.128 | 0.184 |
| 5 | | | | | 1.000 | -0.321 | 0.064 | -0.014 | 0.038 | -0.043 | -0.088 | 0.017 | 0.217 | -0.080 | 0.113 | -0.101 | 0.037 | 0.045 |
| 6 | | | | | | 1.000 | -0.209 | -0.041 | -0.247 | -0.207 | 0.287 | -0.182 | 0.094 | 0.234 | -0.230 | 0.141 | 0.152 | 0.211 |
| 7 | | | | | | | 1.000 | 0.371 | -0.189 | 0.145 | 0.219 | -0.219 | 0.202 | -0.097 | -0.106 | 0.146 | 0.024 | 0.015 |
| 8 | | | | | | | | 1.000 | -0.091 | -0.010 | 0.009 | -0.098 | 0.075 | 0.110 | 0.101 | 0.042 | -0.033 | -0.058 |
| 9 | | | | | | | | | 1.000 | 0.471 | -0.923 | 0.976 | -0.284 | -0.120 | 0.121 | -0.042 | -0.407 | -0.475 |
| 10 | | | | | | | | | | 1.000 | -0.343 | 0.411 | -0.091 | -0.302 | 0.078 | -0.040 | -0.557 | -0.536 |
| 11 | | | | | | | | | | | 1.000 | -0.900 | 0.239 | 0.051 | -0.273 | -0.000 | 0.457 | 0.550 |
| 12 | | | | | | | | | | | | 1.000 | -0.332 | -0.144 | 0.097 | -0.066 | -0.374 | -0.443 |
| 13 | | | | | | | | | | | | | 1.000 | 0.083 | -0.091 | 0.234 | 0.209 | 0.197 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.039 | 0.333 | 0.289 | 0.293 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.013 | -0.110 | -0.103 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.019 | -0.029 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.876 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXVIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during September (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 26

Number of 6-Hourly Observations: 163

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 22.19196 | 4.35166 | 12 C SLP | 10 | 3.62136 | 8.12829 |
| LONG | 2 | 129.99129 | 11.09159 | MAX I | 11 | 74.83009 | 45.50163 |
| 12 DIR | 3 | 295.23291 | 27.17735 | MIN 7 HT | 12 | 279.39795 | 26.60837 |
| 12 SPD | 4 | 10.67961 | 4.90535 | 7 R LT | 13 | 31.71358 | 3.32183 |
| 24 DIR | 5 | 294.30566 | 24.97586 | 7 R HT | 14 | 315.11646 | 1.93704 |
| 24 SPD | 6 | 10.33981 | 4.43390 | 7 T LONG | 15 | 119.67961 | 13.00329 |
| SIZE | 7 | 4.48544 | 2.01390 | 7 T HT | 16 | 310.23291 | 3.36321 |
| 12 C SIZ | 8 | -0.14563 | 0.97187 | 12 C I | 17 | -5.53883 | 7.80148 |
| SLP | 9 | 967.45142 | 31.82787 | 24 C I | 18 | -6.78641 | 14.72218 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.369 | 0.424 | 0.167 | 0.365 | 0.192 | -0.185 | -0.101 | 0.013 | 0.087 | 0.023 | 0.031 | 0.752 | -0.480 | 0.267 | -0.260 | -0.051 | -0.076 |
| 2 | | 1.000 | 0.557 | 0.103 | 0.594 | 0.078 | -0.312 | 0.043 | 0.321 | -0.164 | -0.288 | 0.314 | 0.038 | 0.120 | 0.842 | -0.383 | 0.249 | 0.282 |
| 3 | | | 1.000 | 0.003 | 0.930 | -0.031 | -0.138 | -0.023 | 0.114 | -0.013 | -0.013 | -0.038 | 0.096 | 0.189 | -0.282 | 0.546 | -0.307 | 0.134 |
| 4 | | | | 1.000 | -0.083 | 0.948 | -0.013 | 0.084 | 0.053 | 0.157 | -0.019 | 0.076 | 0.092 | 0.084 | 0.109 | -0.177 | -0.012 | 0.099 |
| 5 | | | | | 1.000 | -0.111 | -0.144 | 0.015 | 0.100 | -0.042 | -0.042 | 0.086 | 0.159 | -0.265 | 0.559 | -0.312 | 0.104 | 0.125 |
| 6 | | | | | | 1.000 | 0.020 | 0.083 | -0.013 | 0.165 | 0.034 | 0.014 | 0.148 | 0.089 | 0.076 | -0.141 | -0.055 | 0.053 |
| 7 | | | | | | | 1.000 | 0.206 | -0.459 | -0.028 | 0.486 | -0.472 | 0.122 | -0.028 | -0.196 | 0.297 | -0.053 | 0.009 |
| 8 | | | | | | | | 1.000 | -0.003 | -0.084 | -0.019 | 0.005 | -0.096 | 0.022 | -0.008 | -0.028 | -0.021 | -0.015 |
| 9 | | | | | | | | | 1.000 | -0.104 | -0.930 | 0.988 | -0.082 | 0.153 | 0.213 | -0.200 | 0.238 | 0.072 |
| 10 | | | | | | | | | | 1.000 | 0.177 | -0.086 | 0.016 | -0.180 | -0.178 | 0.030 | -0.347 | -0.326 |
| 11 | | | | | | | | | | | 1.000 | -0.938 | 0.068 | -0.184 | -0.161 | 0.161 | -0.166 | 0.019 |
| 12 | | | | | | | | | | | | 1.000 | -0.083 | 0.137 | 0.196 | -0.210 | 0.204 | 0.017 |
| 13 | | | | | | | | | | | | | 1.000 | -0.465 | -0.039 | -0.109 | -0.043 | -0.035 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.045 | 0.299 | -0.034 | 0.096 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.306 | 0.228 | 0.258 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.083 | -0.016 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.738 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXIX. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during September (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 93

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 15.63125 | 2.97318 | 12 C SLP | 10 | -5.58209 | 7.88774 |
| LONG | 2 | 130.10814 | 5.05461 | MAX I | 11 | 64.04477 | 32.55223 |
| 12 DIR | 3 | 277.28345 | 37.10646 | MIN 7 HT | 12 | 295.59692 | 18.96968 |
| 12 SPD | 4 | 10.61194 | 3.80571 | 7 R LT | 13 | 27.58208 | 4.41810 |
| 24 DIR | 5 | 278.38794 | 34.56641 | 7 R HT | 14 | 316.34326 | 2.00418 |
| 24 SPD | 6 | 10.56716 | 3.89725 | 7 T LONG | 15 | 121.23880 | 10.11907 |
| SIZE | 7 | 5.02985 | 1.84202 | 7 T HT | 16 | 311.94019 | 2.00666 |
| 12 C SIZ | 8 | 0.43284 | 1.03314 | 12 C I | 17 | 10.59701 | 9.00850 |
| SLP | 9 | 982.67163 | 24.16002 | 24 C I | 18 | 19.00000 | 16.10944 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.125 | -0.291 | -0.388 | -0.256 | -0.430 | -0.235 | -0.122 | -0.158 | 0.023 | 0.139 | -0.166 | 0.400 | -0.052 | -0.369 | -0.045 | -0.116 | -0.086 |
| 2 | | 1.000 | 0.251 | -0.314 | 0.269 | -0.359 | 0.257 | 0.212 | -0.534 | -0.391 | 0.364 | -0.478 | 0.460 | 0.231 | 0.093 | -0.247 | 0.232 | 0.291 |
| 3 | | | 1.000 | 0.276 | 0.954 | 0.324 | -0.020 | -0.129 | -0.375 | -0.253 | 0.235 | -0.316 | 0.037 | 0.366 | 0.039 | 0.185 | 0.119 | 0.134 |
| 4 | | | | 1.000 | 0.264 | 0.913 | -0.450 | -0.192 | 0.399 | 0.302 | -0.361 | 0.374 | -0.291 | 0.055 | -0.080 | 0.241 | -0.142 | -0.152 |
| 5 | | | | | 1.000 | 0.305 | -0.090 | -0.022 | -0.287 | -0.166 | 0.129 | -0.239 | -0.021 | 0.340 | 0.131 | 0.163 | 0.026 | 0.043 |
| 6 | | | | | | 1.000 | -0.401 | -0.145 | 0.350 | 0.268 | -0.299 | 0.373 | -0.161 | 0.258 | -0.174 | 0.411 | -0.168 | -0.121 |
| 7 | | | | | | | 1.000 | 0.399 | -0.592 | -0.519 | 0.626 | -0.536 | 0.312 | 0.272 | 0.142 | -0.135 | 0.538 | 0.578 |
| 8 | | | | | | | | 1.000 | -0.002 | 0.020 | -0.028 | 0.056 | 0.123 | 0.205 | 0.162 | -0.141 | -0.084 | -0.047 |
| 9 | | | | | | | | | 1.000 | 0.832 | -0.950 | 0.959 | -0.580 | -0.476 | 0.088 | 0.091 | -0.683 | -0.797 |
| 10 | | | | | | | | | | 1.000 | -0.823 | 0.859 | -0.299 | -0.326 | 0.030 | 0.287 | -0.834 | -0.874 |
| 11 | | | | | | | | | | | 1.000 | -0.935 | 0.585 | 0.500 | -0.184 | -0.082 | 0.781 | 0.879 |
| 12 | | | | | | | | | | | | 1.000 | -0.465 | -0.329 | 0.041 | 0.244 | -0.734 | -0.820 |
| 13 | | | | | | | | | | | | | 1.000 | 0.588 | -0.384 | 0.209 | 0.220 | 0.363 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.248 | 0.325 | 0.317 | 0.406 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.306 | -0.113 | -0.104 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.239 | -0.158 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.916 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXX. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during October (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 26

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 17.82990 | 6.69193 | 12 C SLP | 10 | 3.25000 | 7.40668 |
| LONG | 2 | 135.43945 | 14.02811 | MAX I | 11 | 95.87500 | 41.02792 |
| 12 DIR | 3 | 284.50000 | 20.14813 | MIN 7 HT | 12 | 273.44995 | 26.81459 |
| 12 SPD | 4 | 9.30000 | 2.87518 | 7 R LT | 13 | 31.29999 | 3.83104 |
| 24 DIR | 5 | 282.19995 | 24.09828 | 7 R HT | 14 | 315.29980 | 2.65252 |
| 24 SPD | 6 | 9.25000 | 2.53943 | 7 T LONG | 15 | 121.97499 | 15.00335 |
| SIZE | 7 | 6.45000 | 2.68853 | 7 T HT | 16 | 309.57495 | 1.76704 |
| 12 C SIZ | 8 | 0.20000 | 1.01779 | 12 C I | 17 | -5.10000 | 6.92005 |
| SLP | 9 | 959.29980 | 31.67720 | 24 C I | 18 | -3.80000 | 17.72899 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.649 | 0.548 | 0.340 | 0.553 | 0.311 | 0.431 | -0.257 | -0.700 | 0.181 | 0.676 | -0.668 | 0.688 | -0.726 | -0.450 | 0.591 | -0.136 | -0.238 |
| 2 | | 1.000 | -0.294 | -0.249 | -0.217 | -0.213 | -0.576 | 0.112 | 0.604 | -0.089 | -0.658 | 0.533 | -0.391 | 0.762 | 0.662 | -0.482 | 0.235 | 0.212 |
| 3 | | | 1.000 | 0.487 | 0.932 | 0.345 | 0.430 | 0.195 | -0.594 | 0.264 | 0.522 | -0.561 | 0.328 | -0.256 | -0.019 | 0.178 | -0.145 | -0.144 |
| 4 | | | | 1.000 | 0.551 | 0.906 | 0.596 | -0.152 | -0.652 | 0.503 | 0.610 | -0.695 | -0.101 | -0.187 | -0.094 | -0.020 | -0.524 | -0.359 |
| 5 | | | | | 1.000 | 0.404 | 0.542 | 0.212 | -0.686 | 0.344 | 0.610 | -0.666 | 0.305 | -0.263 | 0.118 | 0.220 | -0.127 | -0.105 |
| 6 | | | | | | 1.000 | 0.543 | -0.208 | -0.556 | 0.504 | 0.515 | -0.599 | -0.242 | -0.217 | -0.118 | -0.021 | -0.566 | -0.394 |
| 7 | | | | | | | 1.000 | 0.247 | -0.802 | 0.361 | 0.801 | -0.778 | -0.061 | -0.616 | 0.055 | 0.430 | -0.265 | -0.176 |
| 8 | | | | | | | | 1.000 | -0.058 | -0.058 | 0.050 | -0.026 | -0.200 | 0.224 | 0.348 | 0.020 | 0.276 | 0.389 |
| 9 | | | | | | | | | 1.000 | -0.191 | -0.987 | 0.991 | -0.266 | 0.638 | 0.178 | -0.452 | 0.105 | -0.043 |
| 10 | | | | | | | | | | 1.000 | 0.209 | -0.210 | 0.051 | -0.123 | -0.031 | -0.068 | -0.673 | -0.645 |
| 11 | | | | | | | | | | | 1.000 | -0.977 | 0.285 | -0.666 | -0.227 | 0.457 | -0.102 | 0.047 |
| 12 | | | | | | | | | | | | 1.000 | -0.224 | 0.586 | 0.150 | -0.411 | 0.104 | -0.053 |
| 13 | | | | | | | | | | | | | 1.000 | -0.400 | -0.396 | 0.266 | 0.081 | -0.112 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.331 | -0.574 | 0.161 | 0.220 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.040 | 0.250 | 0.179 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.150 | 0.056 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.854 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXXI. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during October (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 115

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 11.16018 | 2.65098 | 12 C SLP | 10 | -7.31325 | 7.48154 |
| LONG | 2 | 143.38083 | 11.90937 | MAX I | 11 | 72.95180 | 36.96675 |
| 12 DIR | 3 | 288.38550 | 22.70209 | MIN 7 HT | 12 | 284.91553 | 22.39072 |
| 12 SPD | 4 | 10.34940 | 3.60362 | 7 R LT | 13 | 27.44577 | 5.34253 |
| 24 DIR | 5 | 287.87939 | 20.44765 | 7 R HT | 14 | 318.00000 | 2.59924 |
| 24 SPD | 6 | 10.27711 | 3.97648 | 7 T LONG | 15 | 127.38553 | 10.57701 |
| SIZE | 7 | 5.63855 | 1.67898 | 7 T HT | 16 | 307.43359 | 4.06108 |
| 12 C SIZ | 8 | 0.12048 | 1.15185 | 12 C I | 17 | 10.14458 | 8.57548 |
| SLP | 9 | 973.39746 | 26.47818 | 24 C I | 18 | 19.55421 | 15.85621 |

Correlation Matrix

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | 1.000 | -0.202 | -0.018 | 0.108 | 0.025 | 0.180 | -0.087 | -0.178 | -0.322 | -0.148 | 0.041 | -0.301 | -0.248 | -0.104 | -0.276 | 0.121 | -0.083 | -0.107 |
| 1 | | 1.000 | 0.123 | -0.464 | 0.207 | -0.528 | 0.414 | 0.270 | 0.486 | 0.438 | -0.410 | 0.443 | 0.864 | 0.260 | 0.615 | -0.361 | -0.560 | -0.574 |
| 2 | | | 1.000 | -0.393 | 0.932 | -0.372 | -0.000 | 0.099 | -0.151 | -0.042 | 0.162 | -0.132 | 0.015 | -0.506 | 0.250 | 0.052 | 0.278 | 0.263 |
| 3 | | | | 1.000 | -0.380 | 0.954 | 0.051 | -0.069 | 0.018 | -0.134 | 0.009 | 0.015 | -0.374 | 0.130 | -0.345 | -0.040 | 0.014 | -0.007 |
| 4 | | | | | 1.000 | -0.389 | 0.072 | 0.188 | -0.125 | -0.031 | 0.141 | -0.109 | 0.029 | -0.469 | 0.273 | -0.035 | 0.189 | 0.211 |
| 5 | | | | | | 1.000 | 0.026 | -0.079 | 0.005 | -0.168 | -0.010 | 0.005 | -0.415 | 0.109 | -0.414 | -0.018 | 0.047 | 0.022 |
| 6 | | | | | | | 1.000 | 0.319 | -0.219 | -0.189 | 0.311 | -0.261 | 0.293 | -0.226 | 0.419 | -0.324 | -0.089 | -0.040 |
| 7 | | | | | | | | 1.000 | 0.208 | 0.036 | -0.163 | 0.214 | 0.154 | -0.004 | 0.078 | -0.194 | -0.207 | -0.106 |
| 8 | | | | | | | | | 1.000 | 0.663 | -0.908 | 0.983 | 0.459 | 0.554 | 0.248 | -0.287 | -0.550 | -0.620 |
| 9 | | | | | | | | | | 1.000 | -0.526 | 0.610 | 0.425 | 0.452 | 0.298 | -0.355 | -0.415 | -0.435 |
| 10 | | | | | | | | | | | 1.000 | -0.923 | -0.365 | -0.499 | -0.119 | 0.143 | 0.631 | 0.731 |
| 11 | | | | | | | | | | | | 1.000 | 0.409 | 0.518 | 0.204 | -0.221 | -0.498 | -0.577 |
| 12 | | | | | | | | | | | | | 1.000 | 0.352 | 0.425 | -0.198 | -0.449 | -0.492 |
| 13 | | | | | | | | | | | | | | 1.000 | -0.104 | -0.156 | -0.442 | -0.462 |
| 14 | | | | | | | | | | | | | | | 1.000 | -0.310 | -0.222 | -0.240 |
| 15 | | | | | | | | | | | | | | | | 1.000 | 0.440 | 0.361 |
| 16 | | | | | | | | | | | | | | | | | 1.000 | 0.908 |
| 17 | | | | | | | | | | | | | | | | | | 1.000 |
| 18 | | | | | | | | | | | | | | | | | | |

TABLE XXXII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during November (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 50

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 16.06786 | 3.52516 | 12 C SLP | 10 | 3.26415 | 10.93006 |
| LONG | 2 | 128.54643 | 6.37001 | MAX I | 11 | 89.05659 | 34.84933 |
| 12 DIR | 3 | 281.33960 | 20.02682 | MIN 7 HT | 12 | 269.83008 | 24.85704 |
| 12 SPD | 4 | 10.94340 | 3.86012 | 7 R LT | 13 | 25.77357 | 3.00410 |
| 24 DIR | 5 | 283.33960 | 17.66125 | 7 R HT | 14 | 316.83008 | 1.68404 |
| 24 SPD | 6 | 11.07547 | 3.58870 | 7 T LONG | 15 | 115.86792 | 9.98657 |
| SIZE | 7 | 5.09434 | 2.17737 | 7 T HT | 16 | 308.92432 | 2.63736 |
| 12 C SIZ | 8 | -0.15094 | 1.08124 | 12 C I | 17 | -5.09434 | 7.30453 |
| SLP | 9 | 955.60376 | 28.58072 | 24 C I | 18 | -4.24528 | 13.67181 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.430 | 0.569 | -0.221 | 0.577 | -0.114 | -0.054 | -0.227 | 0.076 | 0.090 | -0.251 | 0.063 | 0.545 | -0.460 | -0.630 | -0.082 | -0.186 | -0.563 |
| 2 | | 1.000 | -0.319 | 0.175 | -0.321 | -0.003 | 0.454 | 0.219 | -0.251 | -0.096 | 0.261 | -0.248 | 0.231 | 0.236 | 0.626 | -0.063 | 0.279 | 0.354 |
| 3 | | | 1.000 | 0.185 | 0.908 | 0.274 | -0.008 | -0.334 | -0.095 | 0.027 | 0.057 | -0.096 | 0.340 | -0.308 | -0.477 | -0.040 | -0.113 | -0.105 |
| 4 | | | | 1.000 | 0.036 | 0.928 | 0.360 | -0.002 | -0.244 | -0.174 | 0.155 | -0.287 | -0.276 | 0.238 | 0.216 | -0.386 | 0.201 | 0.280 |
| 5 | | | | | 1.000 | 0.156 | -0.121 | -0.330 | 0.001 | 0.031 | -0.024 | 0.002 | 0.341 | -0.318 | -0.435 | 0.150 | 0.062 | -0.006 |
| 6 | | | | | | 1.000 | 0.317 | -0.111 | -0.200 | -0.105 | 0.100 | -0.254 | -0.293 | 0.184 | 0.070 | -0.375 | 0.136 | 0.205 |
| 7 | | | | | | | 1.000 | 0.341 | -0.693 | 0.029 | 0.528 | -0.715 | 0.383 | -0.022 | 0.333 | -0.658 | 0.025 | -0.025 |
| 8 | | | | | | | | 1.000 | -0.037 | -0.097 | -0.050 | -0.048 | -0.017 | 0.218 | 0.488 | -0.152 | 0.108 | 0.203 |
| 9 | | | | | | | | | 1.000 | 0.075 | -0.910 | 0.989 | -0.231 | 0.189 | -0.246 | 0.564 | 0.037 | -0.085 |
| 10 | | | | | | | | | | 1.000 | 0.090 | 0.068 | 0.069 | -0.268 | -0.157 | -0.100 | -0.521 | -0.443 |
| 11 | | | | | | | | | | | 1.000 | -0.888 | 0.069 | -0.239 | 0.349 | -0.443 | -0.051 | 0.152 |
| 12 | | | | | | | | | | | | 1.000 | -0.234 | 0.157 | -0.261 | 0.582 | 0.031 | -0.077 |
| 13 | | | | | | | | | | | | | 1.000 | -0.126 | -0.206 | -0.145 | -0.062 | -0.288 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.184 | 0.144 | 0.202 | 0.344 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.145 | 0.196 | 0.405 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.065 | 0.132 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.742 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXXIII. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during November (1960-1969) for the period after maximum intensity.

Number of East-West Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 21

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 8.56153 | 1.66561 | 12 C SLP | 10 | -9.61538 | 14.07443 |
| LONG | 2 | 137.73833 | 5.43184 | MAX I | 11 | 124.23076 | 31.34792 |
| 12 DIR | 3 | 286.23071 | 10.95562 | MIN 7 HT | 12 | 263.84595 | 27.91905 |
| 12 SPD | 4 | 15.12077 | 1.73944 | 7 R LT | 13 | 21.46153 | 1.12660 |
| 24 DIR | 5 | 284.15481 | 9.40608 | 7 R HT | 14 | 315.92285 | 0.75955 |
| 24 SPD | 6 | 15.30769 | 1.70218 | 7 T LONG | 15 | 129.23076 | 7.29330 |
| SIZE | 7 | 5.46154 | 0.66022 | 7 T HT | 16 | 299.84595 | 3.05085 |
| 12 C SIZ | 8 | -0.07692 | 0.75955 | 12 C I | 17 | 15.00000 | 5.00000 |
| SLP | 9 | 944.46143 | 28.99889 | 24 C I | 18 | 33.46153 | 8.26252 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.940 | 0.918 | -0.595 | 0.967 | -0.801 | -0.331 | 0.300 | -0.818 | 0.397 | 0.963 | -0.790 | 0.854 | -0.516 | -0.622 | -0.219 | 0.070 | 0.026 |
| 2 | | 1.000 | -0.809 | 0.795 | -0.832 | 0.872 | 0.555 | -0.159 | 0.933 | -0.091 | -0.986 | 0.897 | -0.939 | 0.734 | 0.571 | 0.468 | -0.226 | 0.101 |
| 3 | | | 1.000 | -0.427 | 0.941 | -0.782 | -0.212 | 0.373 | -0.754 | 0.433 | 0.884 | -0.740 | 0.639 | -0.458 | -0.525 | -0.166 | 0.228 | 0.267 |
| 4 | | | | 1.000 | -0.415 | 0.847 | 0.625 | -0.049 | 0.880 | 0.418 | -0.761 | 0.869 | -0.782 | 0.835 | 0.468 | 0.698 | -0.479 | 0.056 |
| 5 | | | | | 1.000 | -0.706 | -0.187 | 0.317 | -0.690 | 0.562 | 0.881 | -0.656 | 0.732 | -0.348 | -0.596 | -0.054 | -0.035 | 0.121 |
| 6 | | | | | | 1.000 | 0.530 | -0.238 | 0.964 | 0.082 | -0.909 | 0.966 | -0.776 | 0.793 | 0.444 | 0.620 | -0.539 | -0.289 |
| 7 | | | | | | | 1.000 | 0.575 | 0.654 | 0.428 | -0.485 | 0.578 | -0.646 | 0.741 | -0.110 | 0.783 | -0.252 | 0.065 |
| 8 | | | | | | | | 1.000 | -0.119 | 0.369 | 0.242 | -0.256 | 0.045 | 0.133 | -0.343 | 0.210 | 0.219 | 0.244 |
| 9 | | | | | | | | | 1.000 | 0.156 | -0.940 | 0.982 | -0.856 | 0.868 | 0.404 | 0.696 | -0.517 | -0.117 |
| 10 | | | | | | | | | | 1.000 | 0.157 | 0.147 | 0.082 | 0.533 | -0.266 | 0.673 | -0.622 | 0.152 |
| 11 | | | | | | | | | | | 1.000 | -0.916 | 0.896 | -0.703 | -0.573 | -0.437 | 0.279 | 0.043 |
| 12 | | | | | | | | | | | | 1.000 | -0.816 | 0.829 | 0.381 | 0.687 | -0.570 | -0.189 |
| 13 | | | | | | | | | | | | | 1.000 | -0.637 | -0.420 | -0.511 | 0.074 | -0.141 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.229 | 0.822 | -0.658 | 0.046 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.257 | 0.103 | 0.248 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.710 | -0.142 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.403 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXXIV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during December (1960-1969) for the period before maximum intensity.

Number of East-West Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 9

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 13.71111 | 1.30809 | 12 C SLP | 10 | 9.44444 | 7.19567 |
| LONG | 2 | 125.07768 | 2.43244 | MAX I | 11 | 138.88889 | 40.06071 |
| 12 DIR | 3 | 294.22217 | 2.99073 | MIN 7 HT | 12 | 269.00000 | 10.85127 |
| 12 SPD | 4 | 11.33333 | 1.22474 | 7 R LT | 13 | 23.55554 | 1.33333 |
| 24 DIR | 5 | 294.66650 | 4.44410 | 7 R HT | 14 | 314.00000 | 1.11803 |
| 24 SPD | 6 | 11.77778 | 1.39443 | 7 T LONG | 15 | 114.11110 | 8.25294 |
| SIZE | 7 | 6.11111 | 0.92796 | 7 T HT | 16 | 302.33325 | 1.11803 |
| 12 C SIZ | 8 | 0.11111 | 0.92796 | 12 C I | 17 | -12.77778 | 35.89142 |
| SLP | 9 | 954.22217 | 14.09590 | 24 C I | 18 | -12.77778 | 46.17297 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.912 | 0.399 | -0.127 | 0.356 | -0.129 | 0.061 | -0.465 | 0.576 | 0.335 | -0.399 | 0.670 | 0.519 | -0.538 | 0.806 | -0.781 | -0.902 | -0.926 |
| 2 | | 1.000 | -0.118 | 0.502 | 0.029 | 0.511 | 0.333 | 0.572 | -0.859 | 0.058 | 0.684 | -0.914 | -0.127 | 0.791 | -0.497 | 0.789 | 0.753 | 0.815 |
| 3 | | | 1.000 | 0-660 | 0.712 | 0.523 | 0.440 | -0.055 | -0.247 | 0.506 | 0.414 | -0.173 | 0.655 | 0.336 | 0.647 | -0.212 | -0.419 | -0.276 |
| 4 | | | | 1.000 | 0.781 | 0.927 | 0.843 | 0.403 | -0.845 | 0.747 | 0.798 | -0.781 | 0.714 | 0.822 | 0.441 | 0.274 | -0.047 | 0.074 |
| 5 | | | | | 1.000 | 0.834 | 0.859 | 0.404 | -0.509 | 0.834 | 0.405 | -0.417 | 0.900 | 0.327 | 0.812 | -0.252 | -0.563 | -0.468 |
| 6 | | | | | | 1.000 | 0.891 | 0.504 | -0.862 | 0.808 | 0.767 | -0.801 | 0.747 | 0.722 | 0.459 | 0.294 | -0.051 | 0.028 |
| 7 | | | | | | | 1.000 | 0.419 | -0.748 | 0.909 | 0.643 | -0.670 | 0.853 | 0.602 | 0.618 | 0.080 | -0.271 | -0.196 |
| 8 | | | | | | | | 1.000 | -0.595 | 0.085 | 0.105 | -0.621 | 0.045 | 0.241 | -0.100 | 0.080 | 0.085 | 0.154 |
| 9 | | | | | | | | | 1.000 | -0.532 | -0.847 | 0.991 | -0.393 | -0.896 | -0.015 | -0.584 | -0.364 | -0.459 |
| 10 | | | | | | | | | | 1.000 | 0.585 | -0.424 | 0.961 | 0.466 | 0.788 | -0.005 | -0.411 | -0.387 |
| 11 | | | | | | | | | | | 1.000 | -0.825 | 0.458 | 0.949 | 0.087 | 0.693 | 0.404 | 0.485 |
| 12 | | | | | | | | | | | | 1.000 | -0.276 | -0.886 | 0.106 | -0.639 | -0.461 | -0.555 |
| 13 | | | | | | | | | | | | | 1.000 | 0.335 | 0.914 | -0.224 | -0.604 | -0.550 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.041 | 0.700 | 0.467 | 0.569 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.573 | -0.864 | -0.824 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.898 | 0.868 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.973 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXXV. Means, standard deviations and correlation matrix for East-West tropical storms and typhoons during December (1960-1969) for the period after maximum intensity.

# APPENDIX C

Statistical calculations of the 18 available parameters of the recurving tropical storms and typhoons during the period 1960-1969 are presented. Computations are shown for the two composited periods of the recurving storms: before and after the point of recurvature.

Each table presents (1) the number of tropical storms and typhoons for the period, (2) the number of six-hourly observations during the period, (3) the means and standard deviations of the 18 parameters, and (4) a correlation matrix of the 18 variables.

Number of Recurving Tropical Storms and Typhoons: 68

Number of 6-Hourly Observations: 1252

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 18.36998 | 5.76564 | 12 C SLP | 10 | -4.12897 | 9.28970 |
| LONG | 2 | 142.70726 | 10.26473 | MAX I | 11 | 82.67450 | 37.16492 |
| 12 DIR | 3 | 312.28247 | 39.53185 | MIN 7 HT | 12 | 279.84839 | 23.56303 |
| 12 SPD | 4 | 9.38280 | 4.21954 | 7 R LAT | 13 | 29.02866 | 5.37998 |
| 24 DIR | 5 | 307.87695 | 43.44450 | 7 R HT | 14 | 315.72046 | 2.74565 |
| 24 SPD | 6 | 9.24156 | 4.04324 | 7 T LONG | 15 | 128.13817 | 12.34497 |
| SIZE | 7 | 5.20778 | 2.10837 | 7 T HT | 16 | 306.86060 | 5.59121 |
| 12 C SIZ | 8 | 0.14227 | 1.10843 | 12 C I | 17 | 5.71238 | 11.24244 |
| SLP | 9 | 966.25366 | 27.13858 | 24 C I | 18 | 12.66735 | 18.67787 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.041 | 0.197 | -0.088 | 0.186 | -0.086 | -0.118 | -0.063 | -0.203 | 0.152 | 0.189 | -0.209 | 0.759 | -0.128 | -0.021 | 0.382 | -0.236 | -0.245 |
| 2 | | 1.000 | -0.141 | 0.135 | -0.068 | 0.086 | -0.161 | 0.062 | 0.180 | -0.041 | -0.189 | 0.167 | 0.126 | 0.293 | 0.505 | -0.178 | 0.076 | 0.082 |
| 3 | | | 1.000 | -0.200 | 0.716 | -0.223 | -0.027 | 0.021 | -0.033 | 0.043 | -0.000 | -0.038 | 0.034 | -0.217 | -0.025 | 0.037 | -0.076 | -0.071 |
| 4 | | | | 1.000 | -0.138 | 0.942 | -0.119 | -0.056 | -0.102 | 0.026 | 0.113 | -0.096 | 0.015 | 0.413 | -0.036 | -0.062 | -0.032 | -0.021 |
| 5 | | | | | 1.000 | -0.150 | -0.011 | -0.024 | -0.003 | 0.036 | -0.035 | -0.005 | 0.057 | -0.160 | -0.050 | 0.078 | -0.060 | -0.062 |
| 6 | | | | | | 1.000 | -0.130 | -0.067 | -0.110 | 0.026 | 0.124 | -0.103 | 0.000 | 0.413 | -0.049 | -0.073 | -0.058 | -0.042 |
| 7 | | | | | | | 1.000 | 0.303 | -0.338 | -0.053 | 0.331 | -0.305 | -0.019 | -0.196 | -0.019 | 0.013 | 0.002 | 0.017 |
| 8 | | | | | | | | 1.000 | 0.004 | -0.130 | 0.008 | 0.016 | -0.042 | 0.006 | 0.025 | -0.033 | 0.095 | 0.127 |
| 9 | | | | | | | | | 1.000 | 0.173 | -0.931 | 0.982 | -0.195 | 0.063 | 0.087 | -0.090 | 0.005 | -0.084 |
| 10 | | | | | | | | | | 1.000 | -0.127 | 0.134 | 0.074 | -0.050 | 0.002 | 0.010 | -0.645 | -0.641 |
| 11 | | | | | | | | | | | 1.000 | -0.919 | 0.178 | -0.039 | -0.085 | 0.050 | 0.076 | 0.177 |
| 12 | | | | | | | | | | | | 1.000 | -0.199 | 0.069 | 0.073 | -0.086 | 0.015 | -0.075 |
| 13 | | | | | | | | | | | | | 1.000 | 0.132 | -0.064 | 0.487 | -0.134 | -0.141 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.132 | 0.064 | 0.066 | 0.078 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.161 | 0.042 | 0.041 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.040 | -0.052 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.871 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXXVI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons for all months (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 68

Number of 6-Hourly Observations: 723

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 26.73586 | 6.55985 | 12 C SLP | 10 | 3;78939 | 8.16806 |
| LONG | 2 | 141.68881 | 8.88711 | MAX I | 11 | 72.58635 | 28.87628 |
| 12 DIR | 3 | 42.51363 | 52.93779 | MIN 7 HT | 12 | 284.00903 | 18.32323 |
| 12 SPD | 4 | 13.58182 | 9.73094 | 7 R LAT | 13 | 34.19394 | 6.68204 |
| 24 DIR | 5 | 73.40150 | 107.24602 | 7 R HT | 14 | 310.88013 | 4.25780 |
| 24 SPD | 6 | 12.07121 | 8.17845 | 7 T LONG | 15 | 131.53333 | 12.79126 |
| SIZE | 7 | 5.11515 | 2.40674 | 7 T HT | 16 | 305.10449 | 13.22460 |
| 12 C SIZ | 8 | -0.10152 | 21.63503 | 12 C I | 17 | -5.47576 | 11.65301 |
| SLP | 9 | 970.94385 | 8.16806 | 24 C I | 18 | -8.06667 | 20.09506 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.290 | 0.023 | 0.517 | -0.132 | 0.552 | -0.155 | -0.014 | 0.029 | 0.306 | -0.008 | -0.000 | 0.799 | -0.372 | 0.169 | 0.104 | -0.318 | -0.355 |
| 2 | | 1.000 | 0.036 | 0.432 | -0.129 | 0.471 | 0.101 | 0.001 | 0.139 | 0.094 | -0.205 | 0.134 | 0.298 | -0.262 | 0.641 | -0.051 | -0.115 | -0.141 |
| 3 | | | 1.000 | 0.024 | 0.268 | 0.031 | -0.101 | 0.016 | 0.102 | -0.065 | -0.072 | 0.082 | 0.011 | 0.024 | -0.125 | 0.011 | 0.074 | 0.040 |
| 4 | | | | 1.000 | -0.137 | 0.976 | 0.116 | -0.078 | 0.066 | 0.324 | -0.019 | 0.039 | 0.311 | -0.595 | 0.333 | -0.137 | -0.372 | -0.391 |
| 5 | | | | | 1.000 | -0.142 | -0.022 | 0.037 | -0.125 | -0.106 | 0.167 | -0.140 | -0.148 | 0.149 | -0.135 | -0.073 | 0.141 | 0.138 |
| 6 | | | | | | 1.000 | 0.086 | -0.096 | 0.087 | 0.331 | -0.046 | 0.062 | 0.341 | -0.594 | 0.339 | -0.136 | -0.376 | -0.393 |
| 7 | | | | | | | 1.000 | 0.282 | -0.281 | -0.001 | 0.247 | -0.258 | 0.041 | -0.301 | 0.223 | -0.140 | 0.015 | 0.027 |
| 8 | | | | | | | | 1.000 | 0.002 | -0.042 | -0.042 | 0.019 | 0.044 | 0.050 | 0.003 | 0.016 | 0.023 | 0.047 |
| 9 | | | | | | | | | 1.000 | 0.056 | -0.876 | 0.978 | -0.049 | 0.143 | -0.045 | -0.000 | -0.021 | -0.109 |
| 10 | | | | | | | | | | 1.000 | 0.079 | -0.008 | 0.148 | -0.210 | 0.141 | -0.009 | -0.599 | -0.600 |
| 11 | | | | | | | | | | | 1.000 | -0.891 | 0.015 | -0.178 | -0.035 | -0.031 | 0.074 | 0.154 |
| 12 | | | | | | | | | | | | 1.000 | -0.049 | 0.163 | -0.043 | 0.013 | 0.002 | -0.084 |
| 13 | | | | | | | | | | | | | 1.000 | -0.251 | 0.064 | 0.150 | -0.180 | -0.196 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.386 | 0.231 | 0.214 | 0.210 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.076 | -0.164 | -0.176 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.033 | 0.039 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.817 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXXVII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons for all months (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 17

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 11.85555 | 1.65009 | 12 C SLP | 10 | -1.55556 | 1.42400 |
| LONG | 2 | 136.84428 | 4.00106 | MAX I | 11 | 40.00000 | 3.53553 |
| 12 DIR | 3 | 307.88867 | 24.49716 | MIN 7 HT | 12 | 305.66650 | 1.74005 |
| 12 SPD | 4 | 10.55556 | 7.38429 | 7 R LAT | 13 | 20.55554 | 1.01379 |
| 24 DIR | 5 | 301.00000 | 11.45644 | 7 R HT | 14 | 315.44434 | 8.01561 |
| 24 SPD | 6 | 12.88889 | 7.68837 | 7 T LONG | 15 | 131.66666 | 6.18016 |
| SIZE | 7 | 5.22222 | 0.97183 | 7 T HT | 16 | 296.00000 | 1.00000 |
| 12 C SIZ | 8 | 0.66667 | 1.32288 | 12 C I | 17 | 2.77778 | 6.18016 |
| SLP | 9 | 999.33325 | 3.31662 | 24 C I | 18 | 7.77778 | 9.71825 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.742 | -0.300 | 0.441 | -0.411 | 0.467 | -0.032 | 0.067 | 0.723 | 0.467 | 0.525 | -0.581 | 0.876 | -0.667 | 0.923 | -0.348 | -0.452 | -0.486 |
| 2 | | 1.000 | -0.544 | 0.921 | -0.287 | 0.921 | -0.562 | -0.009 | 0.969 | 0.387 | 0.844 | -0.093 | 0.915 | -0.150 | 0.931 | 0.275 | 0.032 | 0.189 |
| 3 | | | 1.000 | -0.545 | 0.737 | -0.701 | 0.421 | 0.107 | -0.520 | 0.159 | -0.281 | 0.376 | -0.485 | -0.169 | -0.532 | -0.464 | 0.308 | -0.043 |
| 4 | | | | 1.000 | -0.109 | 0.974 | -0.664 | 0.047 | 0.869 | 0.176 | 0.862 | 0.213 | 0.722 | 0.163 | 0.732 | 0.592 | 0.277 | 0.533 |
| 5 | | | | | 1.000 | -0.295 | 0.146 | 0.223 | -0.388 | -0.199 | 0.170 | 0.557 | -0.464 | 0.054 | -0.415 | 0.142 | 0.512 | 0.449 |
| 6 | | | | | | 1.000 | -0.649 | 0.045 | 0.884 | 0.142 | 0.782 | 0.087 | 0.743 | 0.200 | 0.760 | 0.602 | 0.126 | 0.448 |
| 7 | | | | | | | 1.000 | 0.648 | -0.608 | -0.442 | -0.546 | -0.309 | -0.452 | -0.240 | -0.326 | -0.386 | -0.636 | -0.537 |
| 8 | | | | | | | | 1.000 | -0.085 | -0.509 | 0.0 | 0.105 | -0.127 | 0.217 | 0.012 | 0.283 | 0.408 | 0.081 |
| 9 | | | | | | | | | 1.000 | 0.547 | 0.746 | -0.042 | 0.939 | -0.087 | 0.889 | 0.188 | 0.071 | 0.162 |
| 10 | | | | | | | | | | 1.000 | 0.248 | 0.016 | 0.594 | -0.327 | 0.387 | -0.527 | 0.268 | -0.191 |
| 11 | | | | | | | | | | | 1.000 | 0.098 | 0.711 | -0.174 | 0.728 | 0.354 | 0.286 | 0.364 |
| 12 | | | | | | | | | | | | 1.000 | -0.292 | 0.707 | -0.424 | 0.485 | 0.823 | 0.844 |
| 13 | | | | | | | | | | | | | 1.000 | -0.370 | 0.947 | -0.072 | -0.103 | -0.140 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.441 | 0.740 | 0.377 | 0.747 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.000 | -0.269 | -0.171 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.303 | 0.836 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.740 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XXXVIII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during January (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 26

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 15.20765 | 4.05453 | 12 C SLP | 10 | 0.61538 | 1.65111 |
| LONG | 2 | 140.07294 | 6.05479 | MAX I | 11 | 35.19231 | 12.28664 |
| 12 DIR | 3 | 59.07692 | 20.34286 | MIN 7 HT | 12 | 307.30762 | 2.75346 |
| 12 SPD | 4 | 12.23077 | 8.58048 | 7 R LT | 13 | 20.65384 | 3.03239 |
| 24 DIR | 5 | 80.69231 | 80.91547 | 7 R HT | 14 | 313.69214 | 3.46144 |
| 24 SPD | 6 | 10.69231 | 6.93264 | 7 T LONG | 15 | 137.30768 | 6.25312 |
| SIZE | 7 | 5.11538 | 1.21085 | 7 T HT | 16 | 293.73071 | 3.96542 |
| 12 C SIZ | 8 | -0.30769 | 0.83758 | 12 C I | 17 | -1.34615 | 7.00823 |
| SLP | 9 | 999.53833 | 2.95609 | 24 C I | 18 | -1.34615 | 11.18549 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.916 | 0.048 | 0.965 | -0.169 | 0.964 | -0.889 | -0.368 | -0.121 | -0.118 | 0.530 | -0.431 | 0.852 | -0.955 | 0.787 | -0.741 | -0.315 | -0.232 |
| 2 | | 1.000 | 0.271 | 0.897 | -0.163 | 0.927 | -0.878 | -0.361 | 0.222 | -0.031 | 0.218 | -0.077 | 0.692 | -0.791 | 0.937 | -0.474 | -0.363 | -0.347 |
| 3 | | | 1.000 | 0.094 | -0.397 | 0.200 | -0.108 | -0.168 | 0.661 | 0.352 | -0.543 | 0.563 | -0.345 | 0.097 | 0.425 | 0.272 | -0.309 | -0.402 |
| 4 | | | | 1.000 | -0.161 | 0.982 | -0.842 | -0.313 | -0.108 | 0.012 | 0.404 | -0.408 | 0.775 | -0.946 | 0.822 | -0.767 | -0.404 | -0.403 |
| 5 | | | | | 1.000 | -0.216 | 0.203 | 0.288 | -0.011 | -0.033 | 0.024 | -0.025 | -0.009 | 0.113 | -0.220 | 0.091 | 0.214 | 0.150 |
| 6 | | | | | | 1.000 | -0.882 | -0.396 | -0.064 | -0.004 | 0.365 | -0.349 | 0.754 | -0.918 | 0.843 | -0.723 | -0.421 | -0.390 |
| 7 | | | | | | | 1.000 | 0.428 | 0.116 | 0.063 | -0.391 | 0.373 | -0.784 | 0.810 | -0.723 | 0.632 | 0.420 | 0.248 |
| 8 | | | | | | | | 1.000 | 0.150 | 0.126 | -0.035 | 0.181 | -0.390 | 0.283 | -0.218 | 0.311 | -0.005 | -0.153 |
| 9 | | | | | | | | | 1.000 | [illegible] | [illegible] | -0.134 | 0.214 | [illegible] | [illegible] | [illegible] | -0.002 | -0.237 |
| [illegible] | | | | | | | | | | | | | | | | | | |

TABLE XXXIX. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during January (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 40

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 12.76247 | 2.91456 | 12 C SLP | 10 | -1.37500 | 11.49964 |
| LONG | 2 | 136.98096 | 2.36855 | MAX I | 11 | 88.46875 | 33.17497 |
| 12 DIR | 3 | 327.03125 | 33.90543 | MIN 7 HT | 12 | 284.50000 | 18.35666 |
| 12 SPD | 4 | 6.71875 | 2.41279 | 7 R LT | 13 | 20.28125 | 2.63027 |
| 24 DIR | 5 | 288.15625 | 97.95517 | 7 R HT | 14 | 315.50000 | 1.29515 |
| 24 SPD | 6 | 6.78125 | 2.48524 | 7 T LONG | 15 | 125.68750 | 9.09249 |
| SIZE | 7 | 5.31250 | 0.69270 | 7 T HT | 16 | 296.68750 | 6.43296 |
| 12 C SIZ | 8 | 0.0 | 0.87988 | 12 C I | 17 | 2.81250 | 15.34848 |
| SLP | 9 | 972.06250 | 21.96025 | 24 C I | 18 | 9.03125 | 21.53836 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.695 | 0.724 | -0.415 | 0.108 | -0.589 | -0.416 | -0.307 | -0.447 | 0.685 | 0.509 | -0.402 | 0.700 | 0.038 | -0.047 | 0.725 | -0.715 | -0.739 |
| 2 | | 1.000 | -0.633 | 0.413 | 0.006 | 0.527 | 0.057 | 0.293 | 0.790 | -0.302 | -0.837 | 0.760 | -0.119 | -0.390 | -0.333 | -0.198 | 0.344 | 0.320 |
| 3 | | | 1.000 | -0.733 | -0.107 | -0.853 | -0.410 | -0.396 | -0.603 | 0.229 | 0.605 | -0.607 | 0.311 | -0.232 | -0.123 | 0.359 | -0.213 | -0.260 |
| 4 | | | | 1.000 | 0.167 | 0.915 | 0.267 | 0.243 | 0.596 | 0.040 | -0.553 | 0.625 | -0.175 | 0.191 | 0.112 | -0.172 | -0.089 | -0.032 |
| 5 | | | | | 1.000 | 0.113 | -0.015 | -0.267 | 0.193 | 0.034 | -0.203 | 0.246 | 0.152 | -0.186 | -0.369 | 0.200 | -0.190 | -0.104 |
| 6 | | | | | | 1.000 | 0.341 | 0.266 | 0.683 | -0.057 | -0.661 | 0.693 | -0.207 | 0.256 | 0.215 | -0.386 | 0.010 | 0.052 |
| 7 | | | | | | | 1.000 | 0.635 | 0.128 | -0.244 | -0.067 | 0.117 | -0.298 | 0.252 | 0.375 | -0.397 | 0.355 | 0.280 |
| 8 | | | | | | | | 1.000 | 0.115 | -0.086 | -0.081 | 0.092 | -0.014 | 0.255 | 0.274 | -0.160 | 0.268 | 0.182 |
| 9 | | | | | | | | | 1.000 | 0.140 | -0.981 | 0.992 | 0.130 | -0.349 | -0.227 | -0.099 | -0.121 | -0.149 |
| 10 | | | | | | | | | | 1.000 | -0.024 | 0.170 | 0.739 | 0.095 | 0.064 | 0.544 | -0.885 | -0.901 |
| 11 | | | | | | | | | | | 1.000 | -0.971 | -0.075 | 0.376 | 0.250 | 0.170 | 0.066 | 0.072 |
| 12 | | | | | | | | | | | | 1.000 | 0.156 | -0.341 | -0.233 | -0.020 | -0.174 | -0.188 |
| 13 | | | | | | | | | | | | | 1.000 | -0.033 | -0.135 | 0.642 | -0.727 | -0.820 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.690 | -0.248 | -0.097 | -0.082 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.569 | -0.049 | -0.052 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.518 | -0.563 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.947 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XL. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during March (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 24

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 18.20830 | 3.06607 | 12 C SLP | 10 | 2.95833 | 4.64831 |
| LONG | 2 | 145.99988 | 5.36666 | MAX I | 11 | 42.70833 | 7.27400 |
| 12 DIR | 3 | 45.83333 | 26.80469 | MIN 7 HT | 12 | 306.83325 | 4.23921 |
| 12 SPD | 4 | 9.20833 | 4.21156 | 7 R LT | 13 | 23.62500 | 2.58444 |
| 24 DIR | 5 | 42.66666 | 26.42406 | 7 R HT | 14 | 311.16650 | 2.46129 |
| 24 SPD | 6 | 8.54167 | 2.79719 | 7 T LONG | 15 | 131.00000 | 12.03256 |
| SIZE | 7 | 4.75000 | 1.39096 | 7 T HT | 16 | 293.45825 | 7.34242 |
| 12 C SIZ | 8 | -0.25000 | 1.22474 | 12 C I | 17 | -5.75000 | 11.56926 |
| SLP | 9 | 1000.25000 | 4.83869 | 24 C I | 18 | -13.12500 | 24.69695 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.262 | -0.508 | 0.120 | -0.473 | -0.021 | -0.754 | -0.379 | 0.899 | 0.297 | -0.905 | 0.891 | 0.841 | 0.558 | 0.787 | -0.312 | -0.285 | -0.449 |
| 2 | | 1.000 | -0.139 | -0.529 | 0.144 | -0.283 | -0.203 | -0.192 | 0.200 | -0.734 | -0.215 | -0.039 | 0.243 | -0.216 | 0.738 | -0.916 | 0.590 | 0.670 |
| 3 | | | 1.000 | 0.345 | 0.889 | 0.405 | 0.244 | 0.032 | -0.183 | -0.115 | 0.305 | -0.232 | -0.519 | -0.301 | -0.343 | 0.336 | 0.333 | 0.133 |
| 4 | | | | 1.000 | 0.290 | 0.857 | -0.043 | -0.074 | 0.407 | 0.529 | -0.303 | 0.513 | 0.247 | 0.580 | -0.167 | 0.652 | -0.371 | -0.658 |
| 5 | | | | | 1.000 | 0.457 | 0.311 | 0.069 | -0.130 | -0.304 | 0.291 | -0.245 | -0.376 | -0.210 | -0.124 | 0.128 | 0.439 | 0.312 |
| 6 | | | | | | 1.000 | 0.081 | -0.048 | 0.349 | 0.316 | -0.244 | 0.360 | 0.276 | 0.599 | -0.066 | 0.451 | -0.195 | -0.452 |
| 7 | | | | | | | 1.000 | 0.625 | -0.649 | -0.190 | 0.736 | -0.664 | -0.499 | -0.343 | -0.621 | 0.169 | 0.193 | 0.324 |
| 8 | | | | | | | | 1.000 | -0.407 | -0.124 | 0.431 | -0.368 | -0.333 | -0.130 | -0.434 | 0.270 | 0.124 | 0.192 |
| 9 | | | | | | | | | 1.000 | 0.368 | -0.913 | 0.960 | 0.856 | 0.683 | 0.754 | -0.176 | -0.255 | -0.544 |
| 10 | | | | | | | | | | 1.000 | -0.335 | 0.547 | 0.274 | 0.559 | -0.141 | 0.615 | -0.882 | -0.942 |
| 11 | | | | | | | | | | | 1.000 | -0.904 | -0.783 | -0.621 | -0.738 | 0.191 | 0.357 | 0.534 |
| 12 | | | | | | | | | | | | 1.000 | 0.816 | 0.749 | 0.602 | 0.044 | -0.439 | -0.718 |
| 13 | | | | | | | | | | | | | 1.000 | 0.789 | 0.723 | -0.300 | -0.250 | -0.450 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.349 | 0.253 | -0.522 | -0.717 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.703 | 0.060 | 0.023 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.477 | -0.594 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.813 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XLI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during March (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 62

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 12.42217 | 3.28016 | 12 C SLP | 10 | -1.94444 | 6.58304 |
| LONG | 2 | 142.40457 | 11.05612 | MAX I | 11 | 60.83333 | 26.25615 |
| 12 DIR | 3 | 302.94434 | 22.85588 | MIN 7 HT | 12 | 293.22217 | 19.16133 |
| 12 SPD | 4 | 10.62963 | 5.62103 | 7 R LT | 13 | 22.83333 | 3.14882 |
| 24 DIR | 5 | 300.92578 | 20.30412 | 7 R HT | 14 | 315.94434 | 1.72021 |
| 24 SPD | 6 | 10.57407 | 5.09754 | 7 T LONG | 15 | 126.66666 | 3.69168 |
| SIZE | 7 | 4.50000 | 1.41087 | 7 T HT | 16 | 303.64795 | 3.69168 |
| 12 C SIZ | 8 | 0.01852 | 1.22074 | 12 C I | 17 | 4.35185 | 9.21679 |
| SLP | 9 | 982.16650 | 21.81892 | 24 C I | 18 | 9.25926 | 13.64672 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.760 | 0.698 | -0.517 | 0.656 | -0.477 | -0.265 | -0.047 | -0.300 | 0.326 | 0.635 | -0.317 | 0.611 | -0.175 | -0.577 | -0.081 | -0.310 | -0.290 |
| 2 | | 1.000 | -0.325 | 0.272 | -0.263 | 0.192 | 0.457 | 0.076 | -0.134 | -0.180 | -0.276 | -0.135 | -0.295 | 0.063 | 0.580 | -0.114 | 0.102 | 0.118 |
| 3 | | | 1.000 | -0.822 | 0.918 | -0.779 | 0.099 | 0.048 | -0.468 | 0.102 | 0.634 | -0.451 | 0.389 | -0.464 | -0.254 | -0.104 | -0.164 | -0.086 |
| 4 | | | | 1.000 | -0.866 | 0.944 | -0.395 | -0.054 | 0.465 | 0.153 | -0.640 | 0.433 | -0.154 | 0.566 | 0.307 | -0.159 | -0.123 | -0.160 |
| 5 | | | | | 1.000 | -0.879 | 0.227 | 0.102 | -0.494 | 0.125 | 0.652 | -0.482 | 0.362 | -0.542 | -0.263 | -0.083 | -0.144 | -0.066 |
| 6 | | | | | | 1.000 | -0.429 | -0.020 | 0.491 | 0.150 | -0.663 | 0.469 | -0.158 | 0.589 | 0.250 | -0.134 | -0.165 | -0.213 |
| 7 | | | | | | | 1.000 | 0.422 | -0.422 | -0.464 | 0.258 | -0.396 | -0.214 | -0.136 | 0.101 | 0.132 | 0.316 | 0.372 |
| 8 | | | | | | | | 1.000 | 0.176 | 0.049 | -0.195 | 0.202 | -0.225 | -0.062 | 0.263 | -0.099 | -0.007 | -0.107 |
| 9 | | | | | | | | | 1.000 | 0.214 | -0.865 | 0.992 | -0.665 | -0.107 | 0.266 | 0.103 | 0.010 | -0.121 |
| 10 | | | | | | | | | | 1.000 | -0.069 | 0.159 | 0.240 | -0.061 | 0.031 | -0.441 | -0.443 | -0.517 |
| 11 | | | | | | | | | | | 1.000 | -0.865 | 0.724 | -0.011 | -0.486 | -0.004 | 0.070 | 0.206 |
| 12 | | | | | | | | | | | | 1.000 | -0.679 | -0.104 | 0.273 | 0.122 | 0.069 | -0.084 |
| 13 | | | | | | | | | | | | | 1.000 | 0.280 | -0.357 | -0.299 | -0.244 | -0.168 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.036 | -0.131 | 0.123 | 0.139 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.338 | 0.040 | 0.008 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.367 | 0.433 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.787 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XLII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during April (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 20

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 20.56995 | 1.03777 | 12 C SLP | 10 | 5.70000 | 4.01444 |
| LONG | 2 | 138.36493 | 9.56104 | MAX I | 11 | 52.75000 | 17.43216 |
| 12 DIR | 3 | 11.00000 | 15.28673 | MIN 7 HT | 12 | 299.29980 | 11.08863 |
| 12 SPD | 4 | 2.35000 | 2.75824 | 7 R LT | 13 | 27.14999 | 2.30046 |
| 24 DIR | 5 | 23.00000 | 80.81613 | 7 R HT | 14 | 314.25000 | 1.83174 |
| 24 SPD | 6 | 4.25000 | 1.94327 | 7 T LONG | 15 | 131.45000 | 10.28783 |
| SIZE | 7 | 4.00000 | 1.02598 | 7 T HT | 16 | -8.75000 | 9.85086 |
| 12 C SIZ | 8 | -0.25000 | 0.96655 | 12 C I | 17 | -10.00000 | 30.60785 |
| SLP | 9 | 987.50000 | 13.93783 | 24 C I | 18 | -10.00000 | 30.60785 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.036 | 0.272 | 0.430 | -0.165 | -0.534 | -0.331 | -0.265 | 0.724 | -0.132 | -0.872 | 0.695 | 0.434 | -0.004 | 0.013 | 0.033 | -0.068 | -0.082 |
| 2 | | 1.000 | 0.078 | -0.591 | -0.341 | 0.048 | 0.203 | -0.310 | -0.524 | 0.533 | 0.231 | -0.470 | 0.800 | 0.856 | 0.668 | 0.934 | 0.526 | 0.372 |
| 3 | | | 1.000 | 0.137 | 0.019 | 0.041 | -0.238 | -0.313 | 0.123 | -0.140 | -0.182 | 0.172 | -0.033 | -0.028 | 0.043 | 0.134 | 0.157 | 0.141 |
| 4 | | | | 1.000 | 0.401 | -0.047 | -0.409 | -0.143 | 0.628 | -0.223 | -0.437 | 0.550 | -0.307 | -0.633 | -0.618 | -0.579 | -0.492 | -0.218 |
| 5 | | | | | 1.000 | 0.010 | -0.095 | 0.257 | 0.204 | 0.172 | 0.324 | 0.160 | -0.320 | -0.220 | -0.396 | -0.340 | 0.157 | 0.191 |
| 6 | | | | | | 1.000 | 0.106 | 0.147 | -0.695 | 0.037 | 0.553 | -0.727 | -0.244 | -0.181 | -0.038 | -0.168 | -0.196 | 0.164 |
| 7 | | | | | | | 1.000 | 0.690 | -0.493 | 0.460 | 0.338 | -0.472 | -0.000 | -0.000 | 0.703 | 0.240 | 0.234 | 0.277 |
| 8 | | | | | | | | 1.000 | -0.150 | 0.142 | 0.246 | -0.184 | -0.385 | -0.379 | 0.245 | -0.379 | 0.117 | 0.098 |
| 9 | | | | | | | | | 1.000 | -0.343 | -0.760 | 0.973 | -0.093 | -0.316 | -0.449 | -0.416 | -0.193 | -0.264 |
| 10 | | | | | | | | | | 1.000 | 0.377 | -0.361 | 0.404 | 0.297 | 0.439 | 0.532 | 0.576 | 0.593 |
| 11 | | | | | | | | | | | 1.000 | -0.712 | -0.195 | 0.233 | 0.153 | 0.160 | 0.316 | 0.338 |
| 12 | | | | | | | | | | | | 1.000 | -0.113 | -0.232 | -0.370 | -0.342 | -0.179 | -0.210 |
| 13 | | | | | | | | | | | | | 1.000 | 0.728 | 0.468 | 0.758 | 0.282 | 0.116 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.474 | 0.831 | 0.507 | 0.197 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.675 | 0.446 | 0.349 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.538 | 0.312 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.441 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XLIII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during April (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 47

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 17.10803 | 3.35547 | 12 C SLP | 10 | -7.08108 | 13.31952 |
| LONG | 2 | 132.16711 | 2.35967 | MAX I | 11 | 80.27026 | 28.35648 |
| 12 DIR | 3 | 320.62158 | 24.39299 | MIN 7 HT | 12 | 283.21606 | 18.64450 |
| 12 SPD | 4 | 9.18919 | 3.90752 | 7 R LT | 13 | 25.59459 | 1.97849 |
| 24 DIR | 5 | 315.32422 | 22.55367 | 7 R HT | 14 | 315.37817 | 2.37289 |
| 24 SPD | 6 | 9.29730 | 3.87201 | 7 T LONG | 15 | 121.64864 | 9.16277 |
| SIZE | 7 | 4.08108 | 2.11316 | 7 T HT | 16 | 308.70264 | 2.54804 |
| 12 C SIZ | 8 | 0.16216 | 0.98639 | 12 C I | 17 | 9.86486 | 16.97571 |
| SLP | 9 | 971.24316 | 21.17046 | 24 C I | 18 | 19.18918 | 24.13829 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.694 | 0.458 | 0.000 | 0.423 | 0.018 | -0.643 | -0.300 | -0.412 | 0.172 | 0.373 | -0.389 | -0.207 | -0.520 | -0.105 | -0.337 | -0.289 | -0.297 |
| 2 | | 1.000 | -0.612 | 0.391 | -0.569 | 0.365 | 0.215 | 0.167 | 0.249 | -0.195 | -0.257 | 0.237 | -0.115 | 0.737 | 0.616 | 0.507 | 0.197 | 0.209 |
| 3 | | | 1.000 | -0.531 | 0.983 | -0.631 | 0.018 | 0.171 | -0.354 | -0.181 | 0.312 | -0.379 | 0.096 | -0.820 | -0.201 | -0.649 | 0.068 | -0.038 |
| 4 | | | | 1.000 | -0.514 | 0.955 | 0.129 | -0.232 | -0.322 | -0.332 | 0.293 | -0.353 | 0.308 | 0.657 | 0.379 | 0/525 | 0.352 | 0.362 |
| 5 | | | | | 1.000 | -0.628 | 0.068 | 0.224 | -0.341 | -0.212 | 0.289 | -0.369 | 0.090 | -0.810 | -0.237 | -0.649 | 0.126 | 0.024 |
| 6 | | | | | | 1.000 | 0.041 | -0.340 | -0.315 | -0.279 | 0.286 | -0.325 | 0.216 | 0.698 | 0.364 | 0.522 | 0.271 | 0.325 |
| 7 | | | | | | | 1.000 | 0.407 | -0.070 | -0.551 | 0.069 | -0.125 | 0.692 | 0.271 | -0.217 | 0.036 | 0.608 | 0.568 |
| 8 | | | | | | | | 1.000 | 0.414 | -0.033 | -0.419 | 0.358 | 0.063 | 0.056 | -0.239 | -0.036 | 0.059 | -0.053 |
| 9 | | | | | | | | | 1.000 | 0.602 | -0.957 | 0.988 | -0.240 | 0.264 | -0.240 | 0.444 | -0.563 | -0.571 |
| 10 | | | | | | | | | | 1.000 | -0.482 | 0.623 | -0.373 | -0.144 | -0.258 | 0.108 | -0.802 | -0.690 |
| 11 | | | | | | | | | | | 1.000 | -0.945 | 0.257 | -0.264 | 0.201 | -0.501 | 0.554 | 0.586 |
| 12 | | | | | | | | | | | | 1.000 | -0.304 | 0.257 | -0.239 | 0.411 | -0.594 | -0.591 |
| 13 | | | | | | | | | | | | | 1.000 | 0.187 | -0.128 | 0.146 | 0.333 | 0.226 |
| 14 | | | | | | | | | | | | | | 1.000 | 0.347 | 0.708 | 0.070 | 0.088 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.275 | 0.071 | 0.004 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.171 | -0.230 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.918 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XLIV. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during June (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 4

Number of 6-Hourly Observations: 37

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 26.31897 | 4.26709 | 12 C SLP | 10 | 5.69048 | 8.61876 |
| LONG | 2 | 134.52092 | 4.48241 | MAX I | 11 | 72.45238 | 34.18614 |
| 12 DIR | 3 | 32.73808 | 17.43005 | MIN 7 HT | 12 | 284.23804 | 21.73656 |
| 12 SPD | 4 | 13.47619 | 6.64881 | 7 R LT | 13 | 32.30951 | 3.97852 |
| 24 DIR | 5 | 71.19048 | 107.48877 | 7 R HT | 14 | 311.28564 | 3.23310 |
| 24 SPD | 6 | 12.19048 | 5.53145 | 7 T LONG | 15 | 119.52380 | 10.64329 |
| SIZE | 7 | 4.28571 | 1.71486 | 7 T HT | 16 | 306.73804 | 3.72898 |
| 12 C SIZ | 8 | -0.04762 | 1.12515 | 12 C I | 17 | -8.57143 | 12.54482 |
| SLP | 9 | 972.92847 | 24.02983 | 24 C I | 18 | -12.14286 | 28.46696 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.846 | 0.666 | 0.850 | -0.260 | 0.851 | 0.378 | 0.014 | 0.247 | 0.324 | -0.295 | 0.287 | 0.902 | -0.739 | 0.601 | -0.515 | -0.489 | -0.625 |
| 2 | | 1.000 | 0.820 | 0.786 | -0.270 | 0.800 | 0.327 | -0.040 | 0.189 | 0.205 | -0.230 | 0.217 | 0.815 | -0.735 | 0.314 | -0.378 | -0.325 | -0.388 |
| 3 | | | 1.000 | 0.464 | -0.484 | 0.473 | -0.007 | -0.017 | 0.458 | 0.148 | -0.424 | 0.464 | 0.695 | -0.386 | -0.005 | 0.079 | -0.118 | -0.247 |
| 4 | | | | 1.000 | -0.157 | 0.979 | 0.512 | -0.108 | -0.107 | 0.319 | 0.056 | -0.070 | 0.679 | -0.888 | 0.643 | -0.782 | -0.470 | -0.480 |
| 5 | | | | | 1.000 | -0.181 | -0.157 | 0.014 | -0.005 | -0.202 | 0.042 | -0.033 | -0.394 | 0.077 | 0.074 | -0.026 | 0.259 | 0.217 |
| 6 | | | | | | 1.000 | 0.547 | -0.089 | -0.161 | 0.378 | 0.122 | -0.123 | 0.712 | -0.907 | 0.652 | -0.765 | -0.536 | -0.495 |
| 7 | | | | | | | 1.000 | 0.349 | -0.587 | 0.214 | 0.494 | -0.546 | 0.373 | -0.591 | 0.617 | -0.629 | -0.459 | -0.334 |
| 8 | | | | | | | | 1.000 | -0.015 | 0.202 | 0.009 | 0.002 | -0.084 | -0.003 | 0.183 | 0.183 | -0.294 | -0.298 |
| 9 | | | | | | | | | 1.000 | -0.046 | -0.966 | 0.993 | 0.185 | 0.136 | -0.359 | 0.374 | 0.133 | -0.235 |
| 10 | | | | | | | | | | 1.000 | 0.110 | 0.025 | 0.175 | -0.444 | 0.185 | -0.227 | -0.736 | -0.746 |
| 11 | | | | | | | | | | | 1.000 | -0.970 | -0.238 | -0.105 | 0.313 | -0.281 | -0.077 | 0.288 |
| 12 | | | | | | | | | | | | 1.000 | 0.214 | 0.092 | -0.331 | 0.334 | 0.050 | -0.321 |
| 13 | | | | | | | | | | | | | 1.000 | -0.565 | 0.461 | -0.359 | -0.307 | -0.420 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.550 | 0.795 | 0.622 | 0.576 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.650 | -0.415 | -0.348 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.455 | 0.396 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.860 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XLV. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during June (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 49

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 24.46999 | 5.26751 | 12 C SLP | 10 | -3.40000 | 5.98516 |
| LONG | 2 | 136.10991 | 10.22012 | MAX I | 11 | 56.79999 | 22.70486 |
| 12 DIR | 3 | 337.09985 | 12.50288 | MIN 7 HT | 12 | 298.29980 | 11.46056 |
| 12 SPD | 4 | 10.70000 | 8.52512 | 7 R LT | 13 | 33.00000 | 3.05505 |
| 24 DIR | 5 | 329.89990 | 11.95779 | 7 R HT | 14 | 317.29980 | 1.15950 |
| 24 SPD | 6 | 10.20000 | 7.28468 | 7 T LONG | 15 | 99.00000 | 9.03081 |
| SIZE | 7 | 3.40000 | 0.51640 | 7 T HT | 16 | 303.79980 | 4.02216 |
| 12 C SIZ | 8 | 0.0 | 0.81650 | 12 C I | 17 | 6.50000 | 9.25262 |
| SLP | 9 | 989.79980 | 13.77437 | 24 C I | 18 | 15.80000 | 16.58513 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.928 | 0.022 | 0.804 | -0.166 | 0.960 | 0.185 | -0.256 | 0.911 | 0.975 | -0.918 | 0.831 | 0.975 | 0.693 | -0.510 | -0.534 | -0.857 | 0.985 |
| 2 | | 1.000 | -0.269 | 0.901 | -0.476 | 0.935 | 0.448 | 0.052 | 0.924 | 0.930 | -0.961 | 0.846 | 0.954 | 0.834 | -0.269 | -0.372 | -0.839 | -0.919 |
| 3 | | | 1.000 | -0.409 | 0.957 | -0.166 | -0.730 | -0.697 | -0.324 | -0.084 | 0.347 | -0.396 | -0.052 | -0.608 | -0.336 | 0.025 | -0.041 | -0.085 |
| 4 | | | | 1.000 | -0.575 | 0.919 | 0.560 | 0.192 | 0.830 | 0.884 | -0.883 | 0.769 | 0.811 | 0.741 | -0.367 | -0.511 | -0.818 | -0.803 |
| 5 | | | | | 1.000 | -0.336 | -0.749 | -0.637 | -0.465 | -0.263 | 0.505 | -0.489 | -0.268 | -0.743 | -0.303 | 0.032 | 0.171 | 0.116 |
| 6 | | | | | | 1.000 | 0.331 | -0.131 | 0.931 | 0.988 | -0.945 | 0.866 | 0.934 | 0.755 | -0.495 | -0.594 | -0.841 | -0.938 |
| 7 | | | | | | | 1.000 | 0.791 | 0.434 | 0.309 | -0.495 | 0.848 | 0.211 | 0.520 | 0.095 | -0.171 | -0.256 | -0.171 |
| 8 | | | | | | | | 1.000 | -0.030 | -0.182 | -0.048 | 0.047 | -0.223 | 0.117 | 0.377 | 0.203 | 0.103 | 0.222 |
| 9 | | | | | | | | | 1.000 | 0.922 | -0.989 | 0.979 | 0.892 | 0.888 | -0.392 | -0.578 | -0.686 | -0.847 |
| 10 | | | | | | | | | | 1.000 | -0.934 | 0.846 | 0.954 | 0.724 | -0.543 | -0.613 | -0.875 | -0.953 |
| 11 | | | | | | | | | | | 1.000 | -0.955 | -0.911 | -0.880 | 0.372 | 0.541 | 0.754 | 0.874 |
| 12 | | | | | | | | | | | | 1.000 | 0.787 | 0.870 | -0.373 | -0.604 | -0.553 | -0.751 |
| 13 | | | | | | | | | | | | | 1.000 | 0.753 | -0.395 | -0.425 | -0.884 | -0.963 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.011 | -0.295 | -0.482 | -0.609 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.912 | 0.525 | 0.490 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.454 | 0.462 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.902 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XLVI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during July (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 60

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 26.39998 | 7.01227 | 12 C SLP | 10 | -3.00000 | 4.12310 |
| LONG | 2 | 134.29079 | 9.79011 | MAX I | 11 | 78.18181 | 37.93629 |
| 12 DIR | 3 | 28.09090 | 13.33757 | MIN 7 HT | 12 | 284.27271 | 21.33115 |
| 12 SPD | 4 | 7.45455 | 7.50151 | 7 R LT | 13 | 35.63635 | 2.97566 |
| 24 DIR | 5 | 21.36363 | 17.72159 | 7 R HT | 14 | 315.45435 | 1.29334 |
| 24 SPD | 6 | 7.00000 | 5.01996 | 7 T LONG | 15 | 105.36363 | 10.83764 |
| SIZE | 7 | 3.63636 | 0.50452 | 7 T HT | 16 | 307.72705 | 4.19740 |
| 12 C SIZ | 8 | 0.27273 | 0.46710 | 12 C I | 17 | 5.45455 | 5.27946 |
| SLP | 9 | 974.36353 | 25.14069 | 24 C I | 18 | 10.00000 | 11.07249 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.995 | -0.435 | 0.756 | -0.394 | 0.995 | -0.537 | -0.031 | 0.967 | 0.806 | -0.956 | 0.958 | 0.827 | 0.517 | -0.807 | -0.960 | -0.844 | -0.988 |
| 2 | | 1.000 | -0.429 | 0.725 | -0.452 | 0.995 | -0.578 | -0.041 | 0.982 | 0.792 | -0.972 | 0.975 | 0.835 | 0.590 | -0.842 | -0.978 | -0.831 | -0.988 |
| 3 | | | 1.000 | -0.216 | 0.682 | -0.439 | 0.466 | 0.301 | -0.457 | -0.500 | 0.418 | -0.445 | -0.012 | -0.078 | 0.317 | 0.492 | 0.457 | 0.494 |
| 4 | | | | 1.000 | -0.080 | 0.775 | -0.586 | -0.267 | 0.676 | 0.540 | -0.681 | 0.668 | 0.608 | 0.337 | -0.561 | -0.628 | -0.670 | -0.731 |
| 5 | | | | | 1.000 | -0.420 | 0.710 | 0.059 | -0.577 | -0.155 | 0.574 | -0.590 | -0.174 | -0.667 | 0.672 | 0.596 | 0.388 | 0.496 |
| 6 | | | | | | 1.000 | -0.592 | -0.085 | 0.970 | 0.807 | -0.958 | 0.961 | 0.817 | 0.554 | -0.818 | -0.963 | -0.860 | -0.984 |
| 7 | | | | | | | 1.000 | 0.463 | -0.659 | -0.288 | 0.657 | -0.659 | -0.230 | -0.641 | 0.722 | 0.657 | 0.444 | 0.591 |
| 8 | | | | | | | | 1.000 | -0.001 | -0.363 | -0.054 | 0.032 | 0.294 | 0.105 | -0.140 | 0.042 | -0.055 | -0.000 |
| 9 | | | | | | | | | 1.000 | 0.697 | -0.996 | 0.999 | 0.793 | 0.665 | -0.922 | -0.994 | -0.801 | -0.979 |
| 10 | | | | | | | | | | 1.000 | -0.643 | 0.664 | 0.554 | 0.131 | -0.385 | -0.734 | -0.684 | -0.749 |
| 11 | | | | | | | | | | | 1.000 | -0.999 | -0.813 | -0.695 | 0.942 | 0.983 | 0.788 | 0.975 |
| 12 | | | | | | | | | | | | 1.000 | 0.799 | 0.684 | -0.935 | -0.990 | -0.796 | -0.976 |
| 13 | | | | | | | | | | | | | 1.000 | 0.645 | -0.712 | -0.753 | -0.682 | -0.813 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.798 | -0.638 | -0.429 | -0.580 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.897 | 0.638 | 0.848 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.796 | 0.970 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.835 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XLVII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during July (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 12

Number of 6-Hourly Observations: 211

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 23.90071 | 4.50846 | 12 C SLP | 10 | -3.24193 | 8.03073 |
| LONG | 2 | 141.67549 | 9.56844 | MAX I | 11 | 73.91934 | 32.83086 |
| 12 DIR | 3 | 332.07251 | 39.30473 | MIN 7 HT | 12 | 287.75806 | 17.40538 |
| 12 SPD | 4 | 9.21774 | 3.49345 | 7 R LT | 13 | 33.76613 | 3.47606 |
| 24 DIR | 5 | 330.69336 | 41.81898 | 7 R HT | 14 | 316.92725 | 2.58566 |
| 24 SPD | 6 | 9.12903 | 3.13118 | 7 T LONG | 15 | 112.92741 | 10.17658 |
| SIZE | 7 | 4.03226 | 1.43099 | 7 T HT | 16 | 309.44336 | 4.60522 |
| 12 C SIZ | 8 | 0.08871 | 1.10440 | 12 C I | 17 | 4.47581 | 11.59506 |
| SLP | 9 | 974.24170 | 21.33408 | 24 C I | 18 | 9.75806 | 19.94760 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.147 | -0.085 | 0.040 | -0.117 | 0.143 | -0.202 | -0.174 | -0.262 | 0.236 | 0.227 | -0.292 | 0.610 | -0.066 | 0.324 | 0.073 | -0.297 | -0.313 |
| 2 | | 1.000 | -0.085 | -0.093 | -0.018 | -0.115 | -0.216 | 0.028 | 0.186 | 0.038 | -0.008 | 0.185 | 0.154 | 0.498 | 0.318 | -0.395 | 0.018 | 0.041 |
| 3 | | | 1.000 | -0.376 | 0.940 | -0.339 | -0.078 | 0.036 | 0.232 | 0.056 | -0.250 | 0.159 | -0.237 | -0.329 | -0.243 | 0.197 | -0.026 | -0.058 |
| 4 | | | | 1.000 | -0.386 | 0.882 | 0.033 | -0.064 | -0.225 | 0.067 | 0.167 | -0.224 | 0.093 | 0.224 | 0.080 | 0.133 | -0.216 | -0.154 |
| 5 | | | | | 1.000 | -0.391 | -0.076 | 0.024 | 0.260 | 0.045 | -0.274 | 0.181 | -0.244 | -0.288 | -0.246 | 0.183 | -0.015 | -0.054 |
| 6 | | | | | | 1.000 | 0.010 | -0.121 | -0.264 | 0.109 | 0.179 | -0.269 | 0.099 | 0.200 | 0.149 | 0.156 | -0.257 | -0.215 |
| 7 | | | | | | | 1.000 | 0.353 | -0.408 | 0.008 | 0.380 | -0.405 | 0.191 | 0-192 | -0.384 | 0.072 | -0.057 | -0.037 |
| 8 | | | | | | | | 1.000 | 0.026 | -0.142 | -0.004 | 0.038 | -0.094 | -0.012 | 0.009 | -0.070 | 0.129 | 0.141 |
| 9 | | | | | | | | | 1.000 | 0.165 | -0.926 | 0.983 | -0.285 | -0.184 | 0.169 | 0.223 | -0.055 | -0.149 |
| 10 | | | | | | | | | | 1.000 | -0.112 | 0.131 | 0.061 | -0.027 | -0.024 | 0.028 | -0.710 | -0.683 |
| 11 | | | | | | | | | | | 1.000 | -0.918 | 0.290 | 0.178 | -0.165 | -0.418 | 0.124 | 0.220 |
| 12 | | | | | | | | | | | | 1.000 | -0.304 | -0.155 | 0.195 | 0.152 | -0.051 | -0.143 |
| 13 | | | | | | | | | | | | | 1.000 | 0.316 | -0.021 | 0.086 | -0.102 | -0.090 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.134 | -0.256 | -0.110 | 0.148 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.058 | 0.164 | 0.148 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.032 | -0.050 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.889 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XLVIII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during August (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 12

Number of 6-Hourly Observations: 201

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 31.71289 | 5.53769 | 12 C SLP | 10 | 2.00000 | 6.15640 |
| LONG | 2 | 141.94594 | 9.19308 | MAX I | 11 | 64.32520 | 24.61108 |
| 12 DIR | 3 | 36.86179 | 32.28651 | MIN 7 HT | 12 | 290.53638 | 11.93368 |
| 12 SPD | 4 | 10.69106 | 5.42931 | 7 R LT | 13 | 38.02438 | 3.33255 |
| 24 DIR | 5 | 58.27641 | 88.87680 | 7 R HT | 14 | 312.37378 | 3.48390 |
| 24 SPD | 6 | 9.94309 | 4.82870 | 7 T LONG | 15 | 128.69917 | 12.34336 |
| SIZE | 7 | 3.61789 | 1.73921 | 7 T HT | 16 | 309.13818 | 3.36159 |
| 12 C SIZ | 8 | 0.00813 | 1.05190 | 12 C I | 17 | -2.83740 | 9.51730 |
| SLP | 9 | 978.82104 | 14.41250 | 24 C I | 18 | -3.21138 | 16.80951 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.511 | 0.364 | 0.540 | 0.056 | 0.585 | -0.107 | 0.087 | -0.194 | 0.364 | 0.132 | -0.251 | 0.739 | -0.550 | 0.352 | 0.028 | -0.342 | -0.405 |
| 2 | | 1.000 | 0.363 | 0.449 | 0.016 | 0.482 | 0.446 | 0.261 | 0.279 | 0.117 | -0.264 | 0.249 | 0.529 | -0.083 | 0.649 | 0.306 | -0.138 | -0.199 |
| 3 | | | 1.000 | 0.357 | 0.061 | 0.368 | 0.030 | 0.014 | 0.199 | 0.059 | -0.161 | 0.158 | 0.427 | -0.237 | 0.095 | 0.104 | -0.024 | -0.149 |
| 4 | | | | 1.000 | -0.014 | 0.964 | 0.005 | 0.104 | 0.106 | 0.395 | 0.046 | 0.067 | 0.444 | -0.321 | 0.137 | 0.116 | -0.368 | -0.341 |
| 5 | | | | | 1.000 | 0.013 | -0.076 | -0.003 | -0.129 | -0.118 | 0.122 | -0.124 | 0.018 | 0-087 | -0.004 | 0.193 | 0.225 | 0.133 |
| 6 | | | | | | 1.000 | -0.015 | 0.097 | 0.136 | 0.373 | 0.002 | 0.097 | 0.491 | -0.353 | 0.173 | 0.108 | -0.370 | -0.383 |
| 7 | | | | | | | 1.000 | 0.418 | -0.017 | -0.058 | -0.067 | 0.009 | 0.064 | 0.233 | 0.308 | 0.041 | 0.033 | 0.083 |
| 8 | | | | | | | | 1.000 | -0.084 | -0.105 | 0.122 | -0.041 | 0.065 | 0.053 | 0.251 | 0.204 | 0.178 | 0.258 |
| 9 | | | | | | | | | 1.000 | 0.149 | -0.839 | 0.979 | 0.077 | 0.232 | 0.172 | 0.258 | -0.115 | -0.226 |
| 10 | | | | | | | | | | 1.000 | -0.080 | 0.112 | 0.174 | -0.242 | 0.119 | -0.176 | -0.557 | -0.565 |
| 11 | | | | | | | | | | | 1.000 | -0.820 | -0.173 | -0.208 | -0.192 | -0.268 | 0.247 | 0.405 |
| 12 | | | | | | | | | | | | 1.000 | 0.034 | 0.273 | 0.151 | 0.255 | -0.107 | -0.205 |
| 13 | | | | | | | | | | | | | 1.000 | -0.327 | 0.096 | 0.024 | -0.261 | -0.389 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.320 | 0.581 | 0.240 | 0.258 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.089 | -0.185 | -0.187 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.026 | 0.043 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.840 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE XLIX. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during August (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 13

Number of 6-Hourly Observations: 267

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 21.07358 | 4.90181 | 12 C SLP | 10 | -3.80233 | 10.62675 |
| LONG | 2 | 144.03882 | 11.06972 | MAX I | 11 | 91.80620 | 40.26518 |
| 12 DIR | 3 | 302.49129 | 36.37802 | MIN 7 HT | 12 | 272.34106 | 25.05725 |
| 12 SPD | 4 | 9.17442 | 4.20351 | 7 R LT | 13 | 32.58139 | 3.77724 |
| 24 DIR | 5 | 300.51147 | 33.84894 | 7 R HT | 14 | 315.41846 | 3.47798 |
| 24 SPD | 6 | 8.88760 | 4.00180 | 7 T LONG | 15 | 130.86433 | 12.83960 |
| SIZE | 7 | 5.09690 | 1.85313 | 7 T HT | 16 | 309.33325 | 3.78575 |
| 12 C SIZ | 8 | 0.12791 | 1.16828 | 12 C I | 17 | 4.69767 | 11.19547 |
| SLP | 9 | 958.08521 | 28.91414 | 24 C I | 18 | 10.89147 | 19.39482 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.033 | 0.228 | -0.203 | 0.233 | -0.230 | 0.084 | -0.064 | 0.022 | 0.311 | -0.063 | -0.000 | 0.518 | -0.522 | 0.211 | -0.042 | -0.410 | -0.477 |
| 2 | | 1.000 | -0.163 | 0.059 | -0.125 | 0.030 | -0.286 | 0.020 | 0.199 | -0.053 | -0.134 | 0.149 | 0.138 | 0.322 | 0.566 | -0.146 | 0.124 | 0.126 |
| 3 | | | 1.000 | 0.176 | 0.942 | 0.143 | 0.192 | 0.092 | -0.112 | 0.158 | 0.064 | -0.065 | -0.131 | -0.192 | 0.190 | -0.212 | -0.210 | -0.222 |
| 4 | | | | 1.000 | 0.166 | 0.969 | -0.156 | -0.054 | -0.228 | 0.052 | 0.253 | -0.195 | 0.145 | 0.546 | -0.165 | -0.124 | -0.175 | -0.132 |
| 5 | | | | | 1.000 | 0.139 | 0.212 | 0.059 | -0.105 | 0.170 | 0.060 | -0.052 | -0.142 | -0.203 | 0.221 | -0.248 | -0.217 | -0.229 |
| 6 | | | | | | 1.000 | -0.129 | -0.059 | -0.270 | 0.048 | 0.297 | -0.230 | 0.157 | 0.561 | -0.178 | -0.051 | -0.200 | -0.163 |
| 7 | | | | | | | 1.000 | 0.318 | -0.369 | -0.013 | 0.373 | -0.301 | 0.114 | -0.308 | 0.018 | 0.021 | -0.073 | -0.024 |
| 8 | | | | | | | | 1.000 | -0.035 | -0.199 | 0.049 | -0.006 | -0.083 | 0.007 | -0.046 | -0.013 | 0.130 | 0.205 |
| 9 | | | | | | | | | 1.000 | 0.129 | -0.941 | 0.968 | -0.247 | 0.035 | 0.172 | -0.217 | 0.150 | 0.054 |
| 10 | | | | | | | | | | 1.000 | -0.093 | 0.065 | 0.175 | -0.048 | 0.090 | 0.017 | -0.519 | -0.592 |
| 11 | | | | | | | | | | | 1.000 | -0.923 | 0.248 | -0.017 | -0.093 | 0.203 | -0.014 | 0.079 |
| 12 | | | | | | | | | | | | 1.000 | -0.284 | 0.021 | 0.151 | -0.219 | 0.162 | 0.071 |
| 13 | | | | | | | | | | | | | 1.000 | -0.030 | -0.036 | 0.171 | -0.337 | -0.334 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.150 | 0.080 | 0.038 | 0.059 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.047 | 01005 | -0.015 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.086 | -0.084 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.867 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE L. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during September (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 13

Number of 6-Hourly Observations: 73

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 28.30338 | 4.99942 | 12 C SLP | 10 | 3.56522 | 7.10336 |
| LONG | 2 | 138.43097 | 7.21560 | MAX I | 11 | 71.04347 | 26.92244 |
| 12 DIR | 3 | 32.90434 | 21.30763 | MIN 7 HT | 12 | 37.56522 | 17.83984 |
| 12 SPD | 4 | 10.97391 | 5.95959 | 7 R LT | 13 | 311.00000 | 5.54744 |
| 24 DIR | 5 | 71.03477 | 107.23669 | 7 R HT | 14 | 128.46956 | 3.23086 |
| 24 SPD | 6 | 9.86957 | 5.32870 | 7 T LONG | 15 | 308.00000 | 11.36342 |
| SIZE | 7 | 5.06087 | 2.00125 | 7 T HT | 16 | -5.06087 | 3.79518 |
| 12 C SIZ | 8 | -0.05217 | 1.25547 | 12 C I | 17 | -5.06087 | 11.51752 |
| SLP | 9 | 968.79980 | 19.91917 | 24 C I | 18 | -8.62609 | 14.62238 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.477 | -0.044 | 0.690 | -0.108 | 0.765 | -0.191 | -0.108 | 0.093 | 0.068 | -0.082 | 0.105 | 0.645 | -0.395 | -0.010 | -0.273 | -0.151 | -0.163 |
| 2 | | 1.000 | 0.231 | 0.265 | -0.102 | 0.310 | -0.186 | 0.033 | 0.362 | -0.060 | -0.338 | 0.381 | 0.331 | 0.003 | 0.415 | -0.184 | 0.015 | 0.030 |
| 3 | | | 1.000 | 0.015 | -0.213 | -0.004 | -0.033 | 0.105 | 0.177 | -0.048 | -0.166 | 0.182 | -0.027 | -0.028 | 0.200 | -0.113 | -0.066 | 0.040 |
| 4 | | | | 1.000 | -0.083 | 0.959 | -0.129 | -0.092 | 0.129 | -0.036 | -0.155 | 0.140 | 0.639 | -0.467 | 0.067 | -0.413 | -0.042 | -0.044 |
| 5 | | | | | 1.000 | -0.070 | -0.028 | -0.045 | -0.181 | 0.038 | 0.140 | -0.141 | -0.187 | 0.140 | -0.010 | -0.073 | -0.094 | -0.087 |
| 6 | | | | | | 1.000 | -0.238 | -0.126 | 0.150 | -0.018 | -0.177 | 0.167 | 0.640 | -0.425 | 0.049 | -0.385 | -0.048 | -0.032 |
| 7 | | | | | | | 1.000 | 0.312 | -0.365 | 0.224 | 0.407 | -0.420 | 0.269 | -0.351 | 0.151 | -0.273 | -0.195 | -0.337 |
| 8 | | | | | | | | 1.000 | 0.018 | -0.008 | -0.064 | 0.019 | 0.003 | -0.013 | 0.089 | 0.096 | -0.152 | -0.122 |
| 9 | | | | | | | | | 1.000 | -0.216 | -0.884 | 0.976 | 0.075 | 0.096 | 0.042 | 0.072 | 0.240 | 0.436 |
| 10 | | | | | | | | | | 1.000 | 0.377 | -0.332 | 0.099 | -0.010 | 0.036 | 0.077 | -0.433 | -0.461 |
| 11 | | | | | | | | | | | 1.000 | -0.901 | -0.022 | -0.068 | -0.076 | -0.008 | -0.079 | -0.298 |
| 12 | | | | | | | | | | | | 1.000 | 0.072 | 0.144 | 0.030 | 0.077 | 0.263 | 0.467 |
| 13 | | | | | | | | | | | | | 1.000 | -0.413 | -0.053 | -0.265 | -0.139 | -0.209 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.307 | 0.698 | 0.088 | 0.139 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.538 | 0.007 | 0.015 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.023 | 0.030 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.726 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE LI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during September (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 20

Number of 6-Hourly Observations: 322

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 18.68286 | 4.55629 | 12 C SLP | 10 | -5.22266 | 8.47231 |
| LONG | 2 | 143.31659 | 9.61878 | MAX I | 11 | 82.01172 | 33.53586 |
| 12 DIR | 3 | 311.64063 | 40.09172 | MIN 7 HT | 12 | 279.53516 | 23.47285 |
| 12 SPD | 4 | 8.49609 | 3.29347 | 7 R LT | 13 | 28.88672 | 4.29393 |
| 24 DIR | 5 | 308.08594 | 37.30464 | 7 R HT | 14 | 315.67188 | 2.36677 |
| 24 SPD | 6 | 8.41406 | 3.22738 | 7 T LONG | 15 | 130.45313 | 10.47930 |
| SIZE | 7 | 6.00781 | 2.38620 | 7 T HT | 16 | 307.44922 | 4.93378 |
| 12 C SIZ | 8 | 0.18359 | 1.07442 | 12 C I | 17 | 6.57813 | 10.67855 |
| SLP | 9 | 965.94141 | 26.41660 | 24 C I | 18 | 14.41016 | 17.49673 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.226 | 0.271 | 0.105 | 0.250 | 0.064 | 0.009 | -0.085 | -0.353 | 0.087 | 0.356 | -0.354 | 0.744 | -0.136 | 0.057 | 0.271 | -0.138 | -0.085 |
| 2 | | 1.000 | -0.014 | 0.320 | -0.068 | 0.279 | -0.382 | 0.079 | 0.153 | -0.079 | -0.225 | 0.162 | 0.331 | 0.370 | 0.494 | -0.210 | 0.076 | 0.105 |
| 3 | | | 1.000 | -0.203 | 0.921 | -0.221 | 0.129 | -0.039 | -0.127 | -0.036 | 0.117 | -0.158 | 0.107 | -0.168 | 0.074 | 0.112 | -0.028 | 0.017 |
| 4 | | | | 1.000 | -0.207 | 0.938 | -0.107 | 0.025 | -0.173 | 0.024 | 0.146 | -0.182 | 0.157 | 0.250 | 0.262 | -0.276 | 0.035 | 0.049 |
| 5 | | | | | 1.000 | -0.235 | 0.165 | -0.058 | -0.122 | -0.040 | 0.128 | -0.162 | 0.090 | -0.172 | -0.005 | 0.123 | 0.007 | 0.044 |
| 6 | | | | | | 1.000 | -0.136 | 0.011 | -0.153 | 0.023 | 0.110 | -0.167 | 0.110 | 0.225 | 0.241 | -0.291 | 0.005 | 0.022 |
| 7 | | | | | | | 1.000 | 0.275 | -0.277 | 0.006 | 0.352 | -0.230 | 0.090 | -0.225 | -0.309 | 0.212 | -0.003 | 0.028 |
| 8 | | | | | | | | 1.000 | -0.079 | -0.157 | 0.117 | -0.065 | -0.012 | 0.155 | -0.036 | 0.049 | 0.207 | 0.278 |
| 9 | | | | | | | | | 1.000 | 0.215 | -0.925 | 0.985 | -0.104 | 0.261 | 0.013 | 0.038 | -0.055 | -0.170 |
| 10 | | | | | | | | | | 1.000 | -0.205 | 0.171 | 0.117 | -0.142 | -0.003 | 0.044 | -0.725 | -0.703 |
| 11 | | | | | | | | | | | 1.000 | -0.916 | 0.122 | -0.256 | -0.040 | 0.021 | 0.157 | 0.297 |
| 12 | | | | | | | | | | | | 1.000 | -0.089 | 0.262 | -0.026 | 0.053 | -0.039 | -0.158 |
| 13 | | | | | | | | | | | | | 1.000 | 0.226 | -0.125 | 0.450 | -0.124 | -0.118 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.001 | 0.182 | 0.197 | 0.196 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.351 | 0.014 | 0.046 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.082 | -0.089 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.854 |
| 18 | | | | | | | | | | | | | | | | | . | 1.000 |

TABLE LII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during October (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 20

Number of 6-Hourly Observations: 190

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 26.85971 | 5.82878 | 12 C SLP | 10 | 4.09804 | 9.72167 |
| LONG | 2 | 144.69905 | 8.52349 | MAX I | 11 | 83.41176 | 25.42378 |
| 12 DIR | 3 | 37.00000 | 31.60600 | MIN 7 HT | 12 | 276.02930 | 17.56808 |
| 12 SPD | 4 | 15.26961 | 9.67498 | 7 R LT | 13 | 35.49019 | 6.17111 |
| 24 DIR | 5 | 67.35294 | 98.85736 | 7 R HT | 14 | 309.95093 | 4.22606 |
| 24 SPD | 6 | 13.39706 | 8.21765 | 7 T LONG | 15 | 137.42155 | 10.12129 |
| SIZE | 7 | 6.06863 | 2.60827 | 7 T HT | 16 | 305.70093 | 5.60464 |
| 12 C SIZ | 8 | -0.11275 | 1.09725 | 12 C I | 17 | -5.60294 | 12.77013 |
| SLP | 9 | 960.89697 | 20.73518 | 24 C I | 18 | -7.59804 | 21.43607 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.537 | 0.019 | 0.791 | -0.200 | 0.817 | 0.008 | 0.011 | 0.311 | 0.560 | -0.200 | 0.205 | 0.728 | -0.498 | 0.459 | -0.440 | -0.626 | -0.654 |
| 2 | | 1.000 | 0.054 | 0.381 | -0.044 | 0.425 | -0.080 | 0.060 | 0.093 | 0.240 | -0.183 | 0.019 | 0.427 | -0.201 | 0.696 | -0.155 | -0.247 | -0.281 |
| 3 | | | 1.000 | -0.084 | -0.092 | -0.060 | -0.285 | -0.052 | 0.034 | 0.100 | -0.083 | 0.024 | -0.096 | -0.057 | 0.141 | 0.178 | -0.084 | -0.145 |
| 4 | | | | 1.000 | -0.232 | 0.981 | -0.009 | 0.003 | 0.329 | 0.361 | -0.206 | 0.245 | 0.476 | -0.613 | 0.280 | -0.490 | -0.463 | -0.433 |
| 5 | | | | | 1.000 | -0.245 | -0.040 | 0.002 | -0.053 | -0.046 | 0.120 | -0.084 | -0.250 | 0.184 | 0.041 | 0.143 | 0.084 | 0.097 |
| 6 | | | | | | 1.000 | -0.019 | 0.001 | 0.351 | 0.385 | -0.252 | 0.275 | 0.519 | -0.617 | 0.302 | -0.521 | -0.486 | -0.464 |
| 7 | | | | | | | 1.000 | 0.325 | -0.154 | -0.115 | 0.218 | -0.095 | 0.285 | -0.218 | -0.101 | -0.140 | 0.121 | 0.154 |
| 8 | | | | | | | | 1.000 | 0.044 | -0.077 | -0.147 | 0.072 | 0.083 | -0.016 | 0.013 | -0.023 | 0.081 | 0.062 |
| 9 | | | | | | | | | 1.000 | 0.203 | -0.816 | 0.960 | 0.285 | -0.035 | 0.027 | -0.152 | -0.196 | -0.288 |
| 10 | | | | | | | | | | 1.000 | -0.008 | 0.089 | 0.317 | -0.161 | 0.282 | -0.131 | -0.677 | -0.704 |
| 11 | | | | | | | | | | | 1.000 | -0.838 | -0.238 | -0.115 | -0.059 | 0.077 | 0.173 | 0.268 |
| 12 | | | | | | | | | | | | 1.000 | 0.253 | 0.013 | -0.035 | -0.160 | -0.110 | -0.207 |
| 13 | | | | | | | | | | | | | 1.000 | -0.319 | 0.190 | -0.448 | -0.436 | -0.423 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.255 | 0.640 | 0.210 | 0.175 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.167 | -0.311 | -0.367 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.222 | 0.186 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.887 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE LIII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during October (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 198

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 14.09690 | 4.08195 | 12 C SLP | 10 | -4.37349 | 8.48766 |
| LONG | 2 | 142.70528 | 9.42299 | MAX I | 11 | 85.31325 | 42.11461 |
| 12 DIR | 3 | 313.94556 | 48.12259 | MIN 7 HT | 12 | 276.06006 | 24.69048 |
| 12 SPD | 4 | 10.84337 | 4.81155 | 7 R LT | 13 | 25.54819 | 4.21476 |
| 24 DIR | 5 | 307.96973 | 56.42902 | 7 R HT | 14 | 315.43970 | 2.64102 |
| 24 SPD | 6 | 10.54217 | 4.72080 | 7 T LONG | 15 | 126.03613 | 12.62070 |
| SIZE | 7 | 5.57831 | 2.38743 | 7 T HT | 16 | 305.39746 | 4.70831 |
| 12 C SIZ | 8 | 0.15663 | 1.13331 | 12 C I | 17 | 6.92771 | 10.96356 |
| SLP | 9 | 961.18066 | 28.70543 | 24 C I | 18 | 15.21084 | 19.18544 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.359 | 0.176 | 0.115 | 0.078 | 0.205 | -0.184 | 0.050 | -0.419 | 0.107 | 0.453 | -0.402 | 0.526 | -0.078 | -0.244 | 0.141 | -0.198 | -0.149 |
| 2 | | 1.000 | -0.093 | -0.002 | 0.046 | -0.080 | -0.105 | 0.163 | 0.408 | -0.073 | -0.447 | 0.393 | -0.110 | 0.368 | 0.409 | -0.318 | 0.148 | 0.129 |
| 3 | | | 1.000 | -0.337 | 0.529 | -0.392 | -0.274 | 0.047 | 0.012 | -0.028 | -0.088 | -0.004 | 0.179 | -0.421 | 0.111 | 0.105 | -0.024 | 0.003 |
| 4 | | | | 1.000 | -0.243 | 0.933 | -0.135 | -0.159 | -0.143 | -0.057 | 0.227 | -0.142 | -0.060 | 0.580 | -0.284 | 0.185 | 0.118 | 0.088 |
| 5 | | | | | 1.000 | -0.238 | -0.202 | -0.079 | -0.006 | 0.016 | -0.066 | -0.009 | -0.004 | -0.218 | 0.063 | -0.005 | -0.009 | -0.035 |
| 6 | | | | | | 1.000 | -0.150 | -0.160 | -0.181 | -0.034 | 0.282 | -0.178 | -0.007 | 0.565 | -0.316 | 0.179 | 0.075 | 0.087 |
| 7 | | | | | | | 1.000 | 0.280 | -0.398 | 0.070 | 0.349 | -0.386 | 0.001 | -0.159 | 0.068 | -0.118 | -0.173 | -0.190 |
| 8 | | | | | | | | 1.000 | 0.054 | -0.062 | -0.055 | 0.062 | 0.038 | -0.114 | 0.108 | -0.073 | -0.100 | -0.096 |
| 9 | | | | | | | | | 1.000 | 0.044 | -0.952 | 0.991 | -0.120 | -0.081 | 0.295 | 0.040 | 0.109 | -0.006 |
| 10 | | | | | | | | | | 1.000 | -0.019 | 0.021 | 0.025 | -0.016 | -0.074 | 0.075 | -0.654 | -0.603 |
| 11 | | | | | | | | | | | 1.000 | -0.944 | 0.104 | 0.120 | -0.314 | 0.059 | -0.025 | 0.107 |
| 12 | | | | | | | | | | | | 1.000 | -0.114 | -0.064 | 0.301 | 0.046 | 0.119 | -0.002 |
| 13 | | | | | | | | | | | | | 1.000 | 0.072 | -0.115 | 0.225 | 0.028 | 0.024 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.194 | -0.078 | 0.163 | 0.159 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.324 | 0.121 | 0.130 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.023 | -0.008 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.866 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE LIV. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during November (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 9

Number of 6-Hourly Observations: 73

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 26.18938 | 5.70006 | 12 C SLP | 10 | 7.75000 | 9.52346 |
| LONG | 2 | 141.76480 | 10.31071 | MAX I | 11 | 86.32893 | 24.87425 |
| 12 DIR | 3 | 35.77631 | 23.55902 | MIN 7 HT | 12 | 278.05249 | 15.63657 |
| 12 SPD | 4 | 21.85526 | 14.90741 | 7 R LT | 13 | 31.82893 | 4.97295 |
| 24 DIR | 5 | 88.75000 | 122.73222 | 7 R HT | 14 | 308.51294 | 6.06957 |
| 24 SPD | 6 | 18.52631 | 12.97016 | 7 T LONG | 15 | 131.00000 | 14.27907 |
| SIZE | 7 | 5.17105 | 2.27676 | 7 T HT | 16 | 299.76294 | 34.64336 |
| 12 C SIZ | 8 | -0.27632 | 1.16159 | 12 C I | 17 | -10.42105 | 11.33987 |
| SLP | 9 | 964.25000 | 18.96599 | 24 C I | 18 | -17.52631 | 17.06569 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.683 | 0.793 | 0.909 | -0.366 | 0.917 | 0.043 | -0.282 | 0.589 | 0.371 | -0.592 | 0.560 | 0.671 | -0.570 | 0.605 | 0.074 | -0.390 | -0.616 |
| 2 | | 1.000 | 0.572 | 0.638 | -0.234 | 0.662 | -0.129 | -0.278 | 0.413 | -0.096 | -0.589 | 0.457 | 0.632 | -0.456 | 0.736 | 0.029 | -0.074 | -0.188 |
| 3 | | | 1.000 | 0.734 | -0.304 | 0.751 | 0.051 | -0.318 | 0.494 | 0.304 | -0.463 | 0.490 | 0.499 | -0.668 | 0.663 | -0.035 | -0.341 | -0.444 |
| 4 | | | | 1.000 | -0.257 | 0.983 | 0.110 | -0.193 | 0.441 | 0.349 | -0.451 | 0.403 | 0.566 | -0.517 | 0.655 | 0.022 | -0.355 | -0.568 |
| 5 | | | | | 1.000 | -0.222 | 0.093 | 0.085 | -0.348 | -0.187 | 0.367 | -0.357 | -0.374 | 0.162 | -0.261 | -0.247 | 0.249 | 0.295 |
| 6 | | | | | | 1.000 | 0.099 | -0.265 | 0.457 | 0.310 | -0.449 | 0.410 | 0.575 | -0.532 | 0.636 | 0.019 | -0.315 | -0.533 |
| 7 | | | | | | | 1.000 | 0.109 | -0.520 | -0.013 | 0.579 | -0.554 | -0.181 | -0.445 | 0.096 | -0.224 | 0.090 | 0.013 |
| 8 | | | | | | | | 1.000 | -0.110 | 0.038 | 0.042 | -0.078 | -0.131 | 0.253 | -0.234 | -0.009 | -0.106 | -0.039 |
| 9 | | | | | | | | | 1.000 | 0.455 | -0.813 | 0.978 | 0.412 | -0.088 | 0.187 | 0.214 | -0.390 | -0.549 |
| 10 | | | | | | | | | | 1.000 | -0.216 | 0.408 | 0.065 | -0.206 | 0.075 | 0.080 | -0.500 | -0.531 |
| 11 | | | | | | | | | | | 1.000 | -0.854 | -0.616 | 0.059 | -0.391 | -0.208 | 0.498 | 0.578 |
| 12 | | | | | | | | | | | | 1.000 | 0.441 | -0.066 | 0.230 | 0.249 | -0.416 | -0.531 |
| 13 | | | | | | | | | | | | | 1.000 | -0.398 | 0.528 | 0.118 | -0.145 | -0.221 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.672 | 0.109 | 0.030 | 0.103 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.085 | -0.130 | -0.230 |
| 16 | | | | | | | | | | | | | | | | 1.000 | -0.104 | -0.106 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.766 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE LV. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during November (1960-1969) for the period after the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 39

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 11.65482 | 3.47798 | 12 C SLP | 10 | -4.16129 | 9.37762 |
| LONG | 2 | 153.98349 | 10.60255 | MAX I | 11 | 88.70967 | 32.45425 |
| 12 DIR | 3 | 295.35474 | 17.34460 | MIN 7 HT | 12 | 288.00000 | 19.68585 |
| 12 SPD | 4 | 11.32258 | 2.74939 | 7 R LT | 13 | 25.41934 | 2.91861 |
| 24 DIR | 5 | 294.16113 | 13.88302 | 7 R HT | 14 | 315.12891 | 2.26188 |
| 24 SPD | 6 | 11.29032 | 2.61015 | 7 T LONG | 15 | 139.64516 | 11.97092 |
| SIZE | 7 | 5.29032 | 1.32145 | 7 T HT | 16 | 296.96753 | 5.57065 |
| 12 C SIZ | 8 | 0.29032 | 0.97274 | 12 C I | 17 | 6.45161 | 3.01440 |
| SLP | 9 | 975.16113 | 20.83760 | 24 C I | 18 | 13.38710 | 5.68434 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | -0.086 | 0.112 | -0.195 | 0.384 | 0.282 | 0.282 | 0.138 | -0.911 | -0.150 | 0.895 | -0.922 | 0.379 | 0.257 | -0.662 | 0.000 | -0.059 | -0.029 |
| 2 | | 1.000 | 0.065 | -0.099 | 0.188 | -0.378 | -0.354 | -0.197 | 0.889 | 0.135 | -0.852 | 0.893 | -0.375 | -0.246 | 0.649 | -0.079 | 0.057 | 0.036 |
| 3 | | | 1.000 | -0.687 | 0.906 | -0.669 | 0.289 | 0.249 | 0.228 | 0.085 | -0.366 | 0.124 | -0.196 | -0.617 | 0.331 | -0.229 | -0.396 | -0.422 |
| 4 | | | | 1.000 | -0.597 | 0.874 | -0.118 | -0.335 | -0.034 | 0.159 | 0.229 | 0.020 | 0.319 | 0.513 | -0.456 | 0.538 | 0.373 | 0.376 |
| 5 | | | | | 1.000 | -0.692 | 0.190 | 0.228 | 0.385 | 0.120 | -0.484 | 0.264 | -0.196 | -0.667 | 0.311 | -0.240 | -0.195 | -0.366 |
| 6 | | | | | | 1.000 | 0.004 | -0.336 | -0.360 | -0.148 | 0.465 | -0.258 | 0.408 | 0.620 | -0.593 | 0.537 | 0.316 | 0.336 |
| 7 | | | | | | | 1.000 | 0.684 | -0.072 | -0.079 | -0.045 | -0.050 | -0.292 | -0.180 | -0.349 | 0.110 | -0.406 | -0.646 |
| 8 | | | | | | | | 1.000 | 0.012 | 0.100 | -0.072 | -0.040 | -0.361 | -0.381 | -0.065 | -0.287 | -0.421 | -0.485 |
| 9 | | | | | | | | | 1.000 | 0.343 | -0.940 | 0.972 | -0.387 | -0.431 | 0.500 | -0.034 | -0.040 | -0.134 |
| 10 | | | | | | | | | | 1.000 | -0.129 | 0.242 | -0.140 | 0.001 | 0.130 | -0.068 | -0.307 | -0.114 |
| 11 | | | | | | | | | | | 1.000 | -0.947 | 0.418 | 0.470 | -0.571 | -0.037 | 0.022 | 0.155 |
| 12 | | | | | | | | | | | | 1.000 | -0.417 | -0.325 | 0.480 | 0.073 | 0.015 | -0.089 |
| 13 | | | | | | | | | | | | | 1.000 | 0.194 | -0.186 | 0.198 | 0.266 | 0.354 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.168 | -0.559 | 0.242 | 0.302 |
| 15 | | | | | | | | | | | | | | | 1.000 | -0.073 | -0.110 | -0.045 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.491 | 0.377 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.745 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE LVI. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during December (1960-1969) for the period before the point of recurvature.

Number of Recurving Tropical Storms and Typhoons: 2

Number of 6-Hourly Observations: 19

| Variable | | Mean | Standard Deviation | Variable | | Mean | Standard Deviation |
|---|---|---|---|---|---|---|---|
| LAT | 1 | 20.07364 | 4.73636 | 12 C SLP | 10 | 0.68421 | 6.28978 |
| LONG | 2 | 147.77357 | 6.23930 | MAX I | 11 | 71.05263 | 40.36565 |
| 12 DIR | 3 | 51.26315 | 20.51514 | MIN 7 HT | 12 | 283.47363 | 20.04817 |
| 12 SPD | 4 | 19.84210 | 11.87557 | 7 R LT | 13 | 27.15788 | 4.23297 |
| 24 DIR | 5 | 40.84210 | 27.10934 | 7 R HT | 14 | 308.63135 | 4.04434 |
| 24 SPD | 6 | 16.36841 | 10.18283 | 7 T LONG | 15 | 141.89473 | 5.92447 |
| SIZE | 7 | 9.00000 | 3.05505 | 7 T HT | 16 | 299.31567 | 5.28154 |
| 12 C SIZ | 8 | 0.0 | 1.20185 | 12 C I | 17 | -5.21316 | 11.95752 |
| SLP | 9 | 967.63135 | 22.59105 | 24 C I | 18 | -5.52632 | 19.28548 |

Correlation Matrix

| Variable Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.690 | -0.121 | 0.915 | 0.216 | 0.909 | -0.291 | -0.340 | -0.138 | 0.613 | 0.146 | -0.089 | 0.902 | -0.596 | 0.733 | -0.233 | -0.750 | -0.669 |
| 2 | | 1.000 | 0.160 | 0.896 | 0.480 | 0.908 | 0.336 | -0.030 | 0.531 | 0.433 | -0.594 | 0.612 | 0.818 | -0.894 | 0.863 | 0.496 | -0.386 | -0.309 |
| 3 | | | 1.000 | 0.053 | 0.706 | 0.057 | -0.063 | 0.020 | 0.125 | -0.07 | -0.328 | 0.260 | -0.032 | -0.042 | 0.149 | 0.383 | -0.319 | -0.369 |
| 4 | | | | 1.000 | 0.455 | 0.988 | -0.025 | -0.261 | 0.156 | 0.504 | -0.205 | 0.238 | 0.896 | -0.772 | 0.856 | 0.144 | -0.630 | -0.557 |
| 5 | | | | | 1.000 | 0.425 | 0.044 | -0.247 | 0.180 | 0.125 | -0.330 | 0.303 | 0.234 | -0.322 | 0.482 | 0.435 | -0.266 | -0.314 |
| 6 | | | | | | 1.000 | -0.046 | -0.277 | 0.150 | 0.507 | -0.215 | 0.242 | 0.920 | -0.760 | 0.861 | 0.183 | -0.654 | -0.573 |
| 7 | | | | | | | 1.000 | 0.635 | 0.942 | -0.038 | -0.838 | 0.879 | -0.026 | -0.535 | 0.181 | 0.599 | 0.654 | 0.698 |
| 8 | | | | | | | | 1.000 | 0.610 | -0.059 | -0.498 | 0.549 | -0.153 | -0.274 | -0.008 | 0.123 | 0.329 | 0.360 |
| 9 | | | | | | | | | 1.000 | 0.114 | -0.942 | 0.978 | 0.150 | -0.673 | 0.336 | 0.706 | 0.429 | 0.496 |
| 10 | | | | | | | | | | 1.000 | 0.051 | 0.056 | 0.584 | -0.483 | 0.503 | -0.243 | -0.367 | -0.256 |
| 11 | | | | | | | | | | | 1.000 | -0.983 | -0.142 | 0.622 | -0.358 | -0.864 | -0.293 | -0.326 |
| 12 | | | | | | | | | | | | 1.000 | 0.207 | -0.701 | 0.406 | 0.793 | 0.309 | 0.369 |
| 13 | | | | | | | | | | | | | 1.000 | -0.749 | 0.838 | 0.025 | -0.608 | -0.499 |
| 14 | | | | | | | | | | | | | | 1.000 | -0.832 | -0.356 | 0.210 | 0.090 |
| 15 | | | | | | | | | | | | | | | 1.000 | 0.193 | -0.479 | -0.411 |
| 16 | | | | | | | | | | | | | | | | 1.000 | 0.278 | 0.283 |
| 17 | | | | | | | | | | | | | | | | | 1.000 | 0.975 |
| 18 | | | | | | | | | | | | | | | | | | 1.000 |

TABLE LVII. Means, standard deviations and correlation matrix for recurving tropical storms and typhoons during December (1960-1969) for the period after the point of recurvature.

LIST OF REFERENCES


1. Anderson, R. K., E. W. Ferguson, and V. J. Oliver, 1966: The Use of Satellite Pictures in Weather Analysis and Forecasting. WMO Tech. Rept. 75, 184 pp.

2. Atkinson, G. D., 1971: Forecaster's Guide to Tropical Meteorology. Air Weather Service (MAC) United States Air Force Base, Illinois, p. 2-8.

3. Brand, S., 1972: Geographic and Monthly Variation of Rapid Intensification and Low-Latitude Weakening of Tropical Cyclones of the Western North Pacific Ocean. ENVPREDRSCHFAC Tech. Pap. 6-72, 31 pp.

4. Brand, S., and R. F. Gaya, 1971: Intensity Changes of Tropical Storms and Typhoons of the Western North Pacific Ocean. NAVWEARSCHFAC Tech. Pap. 5-71, 200 pp.

5. Burroughs, L. D., and S. Brand, 1972: Speed of Tropical Storms and Typhoons after Recurvature in the Western North Pacific Ocean. ENVPREDRSCHFAC Tech. Rept. 7-72, 36 pp.

6. Dixon, W. J., Biomedical Computer Programs, Los Angeles, Health Sciences Computing Facility, University of California, Los Angeles, 585 pp., 1966.

7. Dunn, G. E., and B. I. Miller, 1964: Atlantic Hurricanes, Louisiana State University Press, p. 33 and p. 291.

8. Fleet Weather Central/Joint Typhoon Warning Center, 1971: Annual Typhoon Report-1970. COMNAVMARIANAS, Guam, 190 pp.

9. Fleet Weather Central/Joint Typhoon Warning Center, 1972: Annual Typhoon Report-1971. COMNAVMARIANAS, Guam, 254 pp.

10. Frank, N. L., and C. L. Jordan, 1960: Climatological Aspects of the Intensity of Typhoons. Geophys. Mag., 30, pp. 131-148.

11. Gray, W. M., 1970: A Climatology of Tropical Cyclones and Disturbances of the Western Pacific with a Suggested Theory for Their Genesis/Maintenance. NAVWEARSCHFAC Tech. Pap. 19-70, 224 pp.

12. Panofsky, H. A., and G. W. Brier, 1958: Some Applications of Statistics to Meteorology, The Pennsylvania State University, p. 95.

13. Riehl, H., 1971: Intensity of Recurving Typhoons. NAVWEARSCHFAC Tech. Pap. 3-71, 11 pp.

14. Riehl, H., and J. Malkus, 1961: Some Aspects of Hurricane Daisy, 1958. Tellus, 13 pp. 181-213.

15. Shea, D. J., 1972: The Structure and Dynamics of the Hurricane's Inner Core Region. Department of Atmospheric Science, Colorado State University, Atmos. Science Pap. No. 182, 134 pp.

16. Yat-kong, FUNG, 1970: A Statistical Analysis of the Intensity of Typhoons: 1958-1968. Roy. Obs., Hong Kong, Tech. Note 9, 18 pp.

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13. ABSTRACT

Six-hourly observations containing 18 parameters of tropical storms and typhoons in the western north Pacific Ocean during the period 1960 through 1969 were examined. The data were composited into four periods: before and after maximum intensity for East-West moving storms, and before and after recurvature for recurving storms.

Monthly and seasonal variations of tropical cyclone intensity, speed of movement and size were examined. Correlation coefficients of the 18 tropical storm and typhoon parameters were computed for each of the four composited periods of study. The four highest correlation values for the past 24-hour change of intensity parameter were checked for levels of significance.

| 14 KEY WORDS | LINK A | | LINK B | | LINK C | |
|---|---|---|---|---|---|---|
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| Tropical cyclones | | | | | | |
| Typhoons | | | | | | |
| North western Pacific Ocean | | | | | | |

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Liechty
Intensity changes of tropical cyclones in the western north Pacific Ocean during 1960-1969.